Four Essays on the Economics of Education and Inequality

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von
Dipl.-Vw. Markus Zimmermann

Präsidentin der Humboldt-Universität zu Berlin:
Prof. Dr.-Ing. Dr. Sabine Kunst

Dekan der Wirtschaftswissenschaftlichen Fakultät:
Prof. Dr. Daniel Klapper

Gutachter:
1. Prof. Bernd Fitzenberger, Ph.D.
2. Prof. Dr. Alexandra Spitz-Oener

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Abstract

This dissertation consists of four essays on the economic analysis of education and inequality.

The *first* essay analyzes changes in housing expenditures and income inequality in Germany since the mid-1990s. The income share of housing expenditures rose disproportionately for the bottom income quintile and fell for the top income quintile. Factors contributing to these trends include a decline in the relative costs of homeownership versus renting, changes in household structure, and residential mobility toward larger cities. Younger cohorts spend more on housing, and save less, than older cohorts did at the same age, with possibly negative consequences for wealth accumulation, particularly at the bottom of the income distribution.

The *second* essay analyzes gaps in transitions after secondary school between native and migrant pupils. It documents that conditional on parental background, cognitive skills, and school fixed effects, there is a pattern of "polarization" of educational choices: migrants are more likely to attend tertiary education, less likely to attend vocational education, and more likely to end without qualified training than their background and skills would predict. This polarization is driven by the migrant pupils' more academically oriented career aspirations and expectations before leaving school, which has differential effects for low- and high-skilled migrants. Finally, various possible explanations for the migrants' different career plans are discussed, such as expected labour market returns to education, expected discrimination, the intention to leave Germany, overconfidence, or information deficits.

The *third* essay studies the causal effects of attending a vocational compared to a general higher secondary school on educational and labour market outcomes. Identification uses both a selection-on-observables strategy including detailed pre-treatment controls as well as instrumental variable estimations using regional schooling infrastructure. The results show that after adjusting for selection, attending a vocational higher secondary school has no effect on higher secondary graduation and a small negative effect on university attendance. Moreover, there is a positive effects on pupils' career planning and tentative evidence for positive effects on labour market outcomes later in life.

The *fourth* essay analyzes changes in intergenerational mobility for West German birth co-

horts 1944 to 1986. Educational participation increased along the whole distribution of parental socio-economic status (SES), especially among girls. However, as these increases were most pronounced among children coming from high parental SES groups, educational disparities by parental background have increased. These patterns also hold after considering "second chance" options in Germany's education system. Finally, we document rising gaps in terms of labour market outcomes between children of different parental SES.

Zusammenfassung

Diese Dissertation umfasst vier Aufsätze zur ökonomischen Analyse von Bildung und Ungleichheit.

Im *erste* Aufsatz werden Veränderungen der Einkommensungleichheit und der Wohnausgaben in Deutschland seit den 1990er Jahren untersucht. Der Anteil des Einkommens, der für das Wohnen ausgegeben wird, stieg zwischen 1993 und 2013 für das unterste Einkommensquintil stark an, während er für das oberste Quintil zurückging. Faktoren, die zu dieser Entwicklung beitrugen, waren ein Rückgang der Kosten des Wohneigentums im Vergleich zur Entwicklung der Mieten, Veränderungen der Haushaltsstruktur, sowie Umzüge von Ost- nach Westdeutschland und in größere Städte. Im Vergleich zu älteren Kohorten geben jüngere Kohorten im gleichen Alter einen höheren Anteil ihres Einkommens für das Wohnen aus und sparen weniger. Angesichts dieser Entwicklung sind negative Konsequenzen für den Vermögensaufbau zu befürchten, insbesondere im unteren Bereich der Verteilung.

Der *zweite* Aufsatz analysiert Unterschiede in den Bildungswegen von Schulabgängern mit und ohne Migrationshintergrund. Es wird gezeigt, dass konditional auf Elternhintergrund, kognitive Fähigkeiten und Schul-Fixed-Effekte eine Polarisierung der Bildungswege besteht: Migranten besuchen häufiger eine tertiäre Ausbildung, seltener eine berufliche Ausbildung und bleiben häufiger ohne qualifizierte Ausbildung als es ihr Hintergrund vorhersagen würde. Diese Polarisierung kann durch die stärker akademisch orientierten Karrierepläne der Migranten erklärt werden, die unterschiedliche Effekte für gering- und hochqualifizierte Schüler haben. Schließlich werden verschiedene mögliche Erklärungen für die unterschiedlichen Karrierepläne der Migranten diskutiert, darunter erwartete Bildungsrenditen, erwartete Diskriminierung, die erwartete Rückkehrmigration, oder Informationsdefizite.

Der *dritte* Aufsatz untersucht, welche Effekte der Besuch eines beruflichen Gymnasiums verglichen mit einem allgemeinbildenden Gymnasium auf spätere Bildungsentscheidungen und Arbeitsmarktergebnisse hat. Zur Identifikation kausaler Effekte wird sowohl ein Selection-on-observables-Ansatz als auch eine Instrumentalvariablenschätzung unter Verwendung regionaler Schulinfrastruktur herangezogen. Die Ergebnisse zeigen, dass nach Berücksichtigung der Se-

lektion der Besuch eines beruflichen Gymnasiums keine Auswirkungen auf den Abschluss des Abiturs und einen kleinen negativen Effekt auf die Studierneigung hat. Weiterhin zeigen sich positive Effekte auf die Karriereplanung, da die Schüler genauer wissen, wo sie sich nach der Schule bewerben wollen. Außerdem gibt es vorsichtige Hinweise darauf, dass Schüler an beruflichen Gymnasien später bessere Arbeitsmarktergebnisse aufweisen.

Der *vierte* Aufsatz untersucht Veränderungen der intergenerationalen Mobilität für die westdeutschen Geburtskohorten 1944 bis 1986. Die Ergebnisse zeigen eine steigende Bildungsbeteiligung für Kinder aus allen sozialen Schichten, insbesondere für Frauen. Da die Zuwächse allerdings stärker für Kinder aus oberen sozialen Schichten waren, ist die soziale Ungleichheit des Bildungszugangs insgesamt gestiegen. Diese Ergebnisse ändern sich nicht wesentlich, wenn "zweite Chancen" im deutschen Bildungssystem berücksichtigt werden. Außerdem zeigen sich steigende Unterschiede in den Arbeitsmarktergebnissen nach dem Hintergrund der Eltern.

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Legal Note

Chapters 1, 3 and 4 of the dissertation are single-authored.

Chapter 2 is based on joint work with Christian Dustmann (University College London) and Bernd Fitzenberger (Humboldt-Universität zu Berlin). A previous version of this chapter has been circulated as a CReAM Discussion Paper (available at `http://www.cream-migration.org/publ_uploads/CDP_16_18.pdf`), as IZA Discussion Paper No. 11953 (`http://ftp.iza.org/dp11953.pdf`) and as ZEW Discussion Paper 18-048 (`https://ssrn.com/abstract=3289094`).

Chapter 5 is based on joint work with Bernd Fitzenberger (Humboldt-Universität zu Berlin) and Aderonke Osikominu (University of Hohenheim).

Contents

Chapter 1

Introduction

Wage and income inequality have strongly increased in Germany since the 1990s.[1] Inequality between different education groups, in particular, has become an increasingly important phenomenon. Figure 1.1 illustrates this by plotting trends in real daily wages from 1995 to 2010 for full-time male workers, separately for different education groups. The figure shows not only pronounced differences in wage levels between these groups, but also very different trends over time. Over the 1995-2010 period, median wages increased for tertiary-educated workers having graduated from universities (+13 %) and universities of applied sciences (+8 %), but also for workers who hold a higher secondary school degree and a vocational degree (+5 %). In contrast, real wage growth was negative for workers with a lower/middle secondary school degree and a vocational degree (-4 %), and for workers who do not hold any postsecondary degree (-9 %).

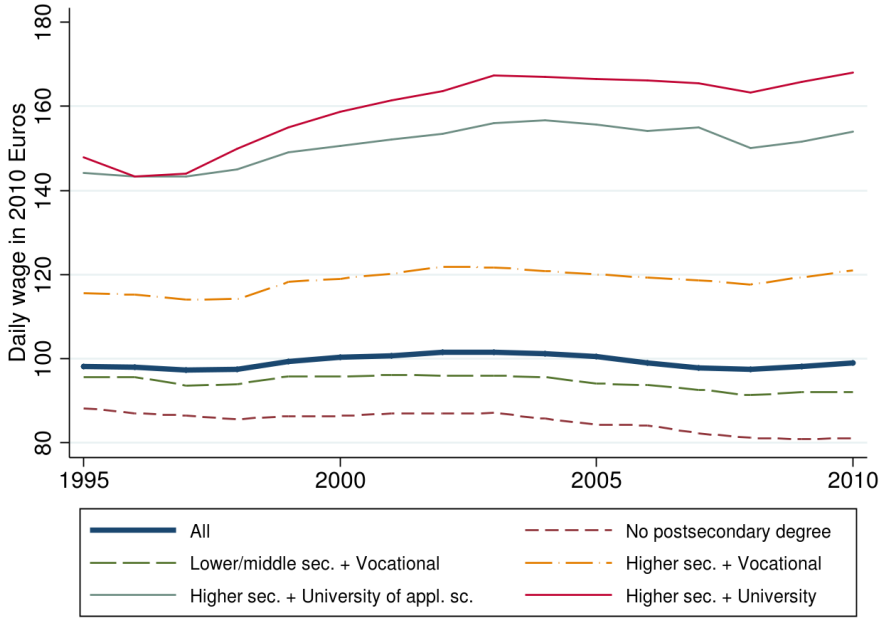
Figure 1.2 plots cumulative wage growth for the 1995-2010 period along the distribution of wages, again separately by education group.[2] For the full sample of workers, real wages declined substantially at the bottom of the distribution (by 8 % at the 15th percentile) but increased at the top (by 12 % at the 85th percentile). This trend of rising wage inequality is also present *within* education groups, but the patterns are quite different for the groups. Among university-educated workers, wage growth was positive across the whole distribution. The groups "Higher sec. + FH" and "Higher sec. + Vocational" also show positive wage growth across large parts of the distribution. In contrast, among workers without a postsecondary degree, real wages declined at most percentiles.

While the previous literature has focused mostly on inequality in wages and incomes, it is also neccessary to better understand other dimensions of inequality which matter for individuals, such as consumption and savings. Chapter 2 will contribute to this goal by analyzing trends in housing

[1] See, among others, Dustmann et al. (2009), Fuchs-Schündeln et al. 2010, or Biewen and Juhasz (2012).

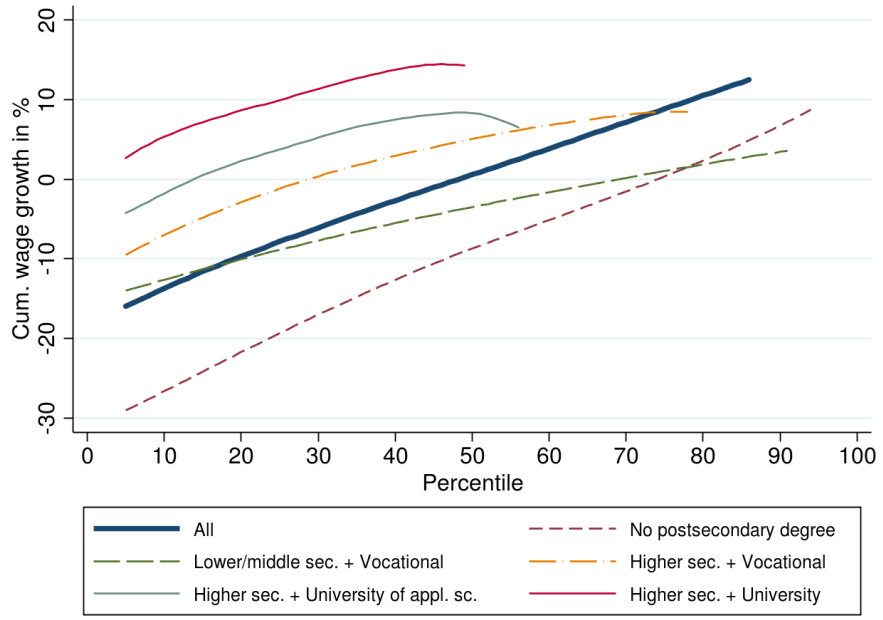
[2] Since the wage information is right-censored, the graph is cut off at the lowest censored percentile in either 1995 or 2010 within each group. This amounts to, for example, the 87th percentile in the full sample and the 52th percentile in the group "Higher sec. + University".

Figure 1.1: Median real daily wages 1995-2010, by education group



Note: Wages have been deflated to 2010 Euros using the German CPI. The sample includes male full-time workers covered by social security, age 25-55. Source: SIAB7510, author calculations.

Figure 1.2: Cumulative growth of real daily wages 1995-2010, by percentile



Note: See Figure 1.1.

expenditures (the largest component of consumptions, especially for low-income individuals) and savings across income groups. Moreover, in light of the rising differentials between educational groups docmented above, it is a key question as to how to young individuals make educational choices and what consequences these choices have for later life outcomes. Chapters 3, 4, and 5 of the dissertation will approach these questions from different angles.

Chapter 2 studies changes in housing expenditures and income inequality in Germany since the 1990s. Most of the economic literature has focused on inequality of wages or household incomes. However, an important question that has received little attention so far in the literature is whether, and to what extent, shifts in housing costs counteract or further exacerbate inequality in disposable income net of housing expenditures. Evidence on this issue is needed given the intensive public debate about housing policy (Handelsblatt 2018). As housing is a necessity good, consumption possibilities of low-income households may be particularly hit by falling real incomes and/or rising housing costs (Albouy et al. 2016, Quigley and Raphael 2004). I analyze these questions by drawing on data from the Income and Expenditure Survey (EVS) in which households record their incomes and expenditures over the period of one quarter, as well as other data sources such as the Socio-Economic Panel (SOEP).

It is found that changes in housing expenditures dramatically exacerbated the trend of income inequality since the mid-1990s. The income share of housing expenditures rose disproportionately for the bottom income quintile and fell for the top quintile. Factors contributing to these trends include a decline in the relative costs of homeownership versus renting, changes in household structure, and residential mobility toward larger cities. Younger cohorts spend more on housing, and save less, than older cohorts did at the same age, with possibly negative consequences for wealth accumulation, particularly at the bottom of the income distribution.

Chapter 3 considers another dimension of inequality which has been an ongoing concern for researchers and policymakers: differences in educational outcomes between migrant and native pupils, which have important implications for migrants' future integration into the labour market and society.[3] The chapter studies which factors explain the migrant-native gaps in transitions after secondary school in Germany, again using the rich survey data from the NEPS SC4.

The analyses in Chapter 3 document that conditional on parental background, cognitive skills, and school fixed effects, there is a pattern of "polarization" of educational choices: migrants are more likely to attend tertiary education, less likely to attend vocational education, and more likely to end without qualified training than their background and skills would predict. This pattern is present among both genders, but is considerably stronger among boys. I argue that a key explanation for this polarization is that migrant pupils and their parents have on average more academically oriented career expectations and aspirations before leaving school than natives of similar parental background and skills. Correspondingly, migrants are less likely to apply for vocational

[3] Previous research on this issue includes, among others, Hunkler (2014) and Diehl et al. (2009) for Germany, Wolter and Zumbuehl (2017) for Switzerland, or Dustmann et al. (2010) for the UK.

training and if they do so, they tend to choose more competitive training occupations. These differences are present along the whole skill distribution, but they have very different effects for low- and high-skilled pupils. On the one hand, their higher aspirations allow high-skilled migrants to achieve tertiary education despite their less favourable background. On the other hand, less skilled migrants, who do not have the option to attend tertiary education, are diverted from vocational training as a more viable alternative. The remaining part of the chapter discusses possible explanations for the migrants' different career plans, such as expected labour market returns to education, expected discrimination, the intention to leave Germany, overconfidence, or information deficits.

Chapter 4 of the dissertation then revisits the debate on the relative benefits of vocational education (i.e. teaching skills in specific occupational fields) vs. academic education (i.e. teaching broader sets of skills).[4] The previous literature has not yet reached a clear consensus on this issue, as the choice of education type may involve several tradeoffs, with pupils' outcomes being affected along several different dimensions and/or having heterogeneous effects for different pupils. I study a specific institutional context on which very little evidence does exist so far. In particular, I compare pupils attending general higher secondary schools (*allgemeinbildende Gymnasien*), which put a stronger focus on academic contents in their curriculum, to pupils attending vocational higher secondary schools (*berufliche Gymnasien/Fachgymnasien*), which also provide access to tertiary education, but have curricula with a stronger focus on vocational knowledge in specific occupational fields and offer more extensive career guidance. In 2015, vocational higher secondary schools awarded about 15 % of all HS degrees (*Abitur*).

The analysis in Chapter 4 uses data from the SC4 and SC6 of the NEPS which allow to plausibly control for selection and to study a broad range of interesting outcomes. Various identification strategies are used to estimate the causal effect of higher secondary school type attended after 10th grade. First, I use a selection-on-observables strategy controlling for extensive pre-treatment characteristics in 9th and 10th grade (such as social background, secondary school type, reading and mathematics test scores, educational and occupational aspirations, or Big 5 personality traits). For two of the outcome variables, the data also allow me to estimate value-added type models, controlling for the lagged outcome in 10th grade. Second, I also estimate the regressions separately for the subsample of pupils who attended middle secondary school until 10th grade, for whom selection into treatment based on observable characteristics is much weaker than in the full sample. Third, I implement an instrumental variable estimation using regional variation in the provision of different types of higher secondary schools, which I argue is plausibly exogenous in the present setting. The results show that after adjusting for selection, attending a vocational higher secondary school has no effect on higher secondary graduation and a small negative effect on university attendance. Moreover, there is a positive effects on pupils' career planning and tentative evidence for positive effects on labour market outcomes later in life.

[4] See Hanushek et al. (2016), Carneiro et al. (2010), and Ryan (2001) for reviews of the international literature.

Finally, **Chapter 5** of the dissertation analyzes changes in intergenerational mobility for West German birth cohorts 1944 to 1986. The question of how educational outcomes vary between children from different parental background groups has key implications for mobility from one generation to the next (see e.g. Chetty et al. 2014, Lindley and Machin 2012). Using survey data from the Adult Cohort (SC6) of the National Educational Panel Study (NEPS), the chapter provides a comprehensive analysis of both transitions within the education system and labour market biographies in adulthood. The results show rising educational participation along the whole distribution of parental socio-economic status (SES), especially among girls. However, as these increases were most pronounced among individuals coming from high parental SES groups, educational disparities by parental background have increased. These patterns also hold after considering "second chance" options in Germany's education system, such as "upgrading" to a higher secondary school degree after 10th grade, or the option to study at university after completing vocational training. Finally, the chapter documents rising gaps in terms of labour market outcomes between children of different parental SES groups.

The remainder of the dissertation consists of four chapters which are self-containing and can be read independently.

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Chapter 2

Housing Expenditures and Income Inequality

2.1 Introduction

Earnings inequality in Germany has sharply increased since the mid-1990s, with real wages rising at the top of the distribution, stagnating at the median, and falling dramatically at the bottom (Dustmann et al. 2009, 2014). A similar increase has occurred in inequality of household equivalized income, with top decile households enjoying substantial income growth, while income at the bottom decile has fallen in real terms (Fuchs-Schündeln et al. 2010, Biewen and Juhasz 2012). An important question that has received little attention so far is whether, and to what extent, shifts in housing costs counteract or further exacerbate inequality in disposable income net of housing expenditures.

This paper addresses this issue with a focus on Germany, which has a large rental market, with 55 % of households renting in 2014, in contrast to 35 % and 36% in the U.S. and UK, respectively (OECD 2014). While Germany until recently experienced unusually stable real house prices overall (Knoll et al. 2017), rental prices increased significantly during the 1990s, and then again after 2010 for newly rented properties. If owner-occupiers and renters are located at different parts of the income distribution, changes in the cost of renting versus ownership will affect inequality in income net of housing expenditures. In addition, because the income share of housing expenditures falls with rising income, the consumption possibilities of low-income households may be particularly hit by falling real incomes and/or rising housing expenditures (Albouy et al. 2016, Quigley and Raphael 2004).

To investigate these conjectures, we first document how inequality of equivalized net household income and differences in housing expenditures by income group translate into inequality of disposable income after housing expenditures. More specifically, we show that whereas the 50/10 ratio of net household income increases from 1.75 to 1.97 (by 22 percentage points, henceforth

pp) between 1993 and 2013, the same ratio net of housing expenditures increases from 1.97 to 2.59 (by 62 pp). For low-income individuals, the increase in the share of income spent on housing occurs concurrently with a decrease in savings rates, which for those in the lowest quintile turn negative in the 2000s. In particular, among individuals in the bottom quintile of net household income, the share of income spent on housing increases from 27% in 1993 to 39% in 2013, while the mean share of non-housing expenditures decreases from 72% to 63% and the savings rate falls from 2% to -1%. Hence, for individuals at the bottom of the distribution, the increase in real housing expenditures exacerbates the loss in real disposable income. For high income groups, in contrast, these changes are reversed, with the share spent on housing decreasing from 16% to 14% in the top quintile of net household income.

Our analysis focuses first on the change in housing costs for renters versus owner-occupiers. Not only did the 1990s see privatization and decreased construction reduce the availability of social rental housing (whose subsidized rents are cheaper than those in private markets), but rental prices overall increased, driven partly by a general rise in residential mobility. This latter means new rental contracts at higher prices than existing agreements, prices that have increased dramatically since 2010. These trends mostly affect individuals in the lower part of the income distribution, who are disproportionally renters with higher rates of residential mobility, with far less impact on individuals further up the income distribution, who are more frequently homeowners. At the same time, homeowners also benefit from falling mortgage interest rates, especially since the late 2000s, which further exacerbates inequality after housing expenditures.

We also note that shrinking household sizes throughout the 1990s and 2000s (due primarily to a rising share of single households) increase housing expenditures per capita, a demographic trend that is strongest at the bottom of the household income distribution. In addition, movements from East to West Germany during the 1990s and the increasing migration of low-income individuals to more expensive urban areas during the 2000s change the regional allocation of households. Lastly, because housing is a necessity good, declining real incomes at the lower end of the distribution increase the share of income spent on housing.

Taking a cohort perspective, we illustrate that successive birth cohorts start with higher inequality at any given age. Moreover, younger cohorts spend more of their income on housing, and save less, than older cohorts did at the same age. This holds in particular for young individuals at the bottom of the distribution, with potentially severe consequences for future wealth inequality.

Our paper contributes to the literature in several ways. First, it adds to the inequality literature by analyzing the link between income inequality, the cost of housing, and inequality in disposable income after housing expenditures. In particular, we show that in addition to the rise in income inequality, changes in the housing market are a second key driver of increased inequality in disposable income, leading to a divergence in consumption and savings patterns across income groups. Our work also relates to the literature on consumption inequality (e.g., Attanasio and Pistaferri 2016, Meyer and Sullivan 2013, and Heathcote et al. 2010 for the U.S., Blundell and Etheridge

2010 for the UK, and Fuchs-Schündeln et al. 2010 for Germany). While these studies concentrate mostly on overall consumption, we focus instead on housing as consumption's most important component, especially for low-income individuals.

Our research also extends the literature on housing markets by analyzing the development in Germany, where homeownership is not only less common than in the U.S. or the UK but also less equally distributed along the income distribution, driven by stricter mortgage regulations, and the virtual absence of a sub-prime lending market (SVR 2013, Voigtländer 2014). We further demonstrate that, although in international comparisons Germany is often seen as an outlier because of its far more moderate housing price development (Knoll et al. 2017), it in fact shows similar trends as the U.S. and UK in rising housing expenditure shares for renters and low-income individuals (Larrimore and Schuetz 2017, Albouy et al. 2016, Quigley and Raphael 2004 for the U.S. and Belfield et al. 2015 for the UK). The literature for the Anglo-Saxon countries has also focused on housing affordability for younger cohorts (Goodman and Mayer 2018, Belfield et al. 2015) and in large cities (Metcalf 2018, Glaeser and Gyourko 2018, Gyourko et al. 2013). To our knowledge, we are the first to provide a comprehensive analysis of these issues for Germany.[1] Lastly, our paper contributes to the literature on the role of regional price differences for inequality (Moretti 2013, Diamond 2016) by showing that in Germany, once regional price differences are taken into account trends in regional mobility reinforce the rise in income inequality in *real* terms rather than mitigating it.

Our analysis is based on the Income and Expenditure Survey (*Einkommens- und Verbrauchsstichprobe*, EVS), a cross-sectional survey conducted every five years by the German Federal Statistical Office. Households record different income sources and various consumption expenditures in a diary over a three-month period. The large sample size, as well as the precise recording of information over a long time period, make this dataset particularly useful for our research purposes. We also draw on household information from the yearly German Socio-Economic Panel (SOEP), as well as various other data sources that report house prices and rents.

The paper proceeds as follows. Section 2.2.1 provides background information and relevant stylized facts on the development of the German housing market over the last two decades. Moreover, Section 2.2.2 describes the datasets used. Section 2.3 discusses the core facts of the trends in household income inequality and housing expenditures across income groups. Section 2.4 then explores explanations for these trends, after which Section 2.5 reports the results of a number of additional analyses. Section 2.6 concludes the paper with a discussion of the findings and their implications.

[1] Most existing papers for Germany focus on renters only (see e.g., Grabka and Verbist 2015, Backhaus et al. 2015, Fitzenberger and Fuchs 2017). Schier and Voigtländer (2015) use aggregate data and show that the costs of homeownership versus renting have decreased in recent years, driven by a fall in mortgage interest rates, but these authors do not consider distributional effects.

2.2 Background and Data

2.2.1 Housing in Germany, the UK, and the U.S.

Patterns of Housing Tenure. As Table 2.1 shows, homeownership rates in Germany are much lower than in the UK or the U.S., with about 45% of German households living in a property they owned in 2014 (19% as owner-occupiers with a mortgage and 26% as owners outright), as compared with around 64% in the UK and 63% in the U.S. In terms of the variation in homeownership across the income distribution, only about 22% of German households in the bottom income quintile are owners, while almost 49% of UK households and 37% of U.S. households in the bottom income quintile own their homes.[2]

Table 2.1: Percent of households living in various tenure types (2014)

	All households	Income quintile				
		Lowest	2nd	3rd	4th	Highest
Germany:						
Renters	54.7	77.2	60.2	51.1	44.6	35.0
Owner with mortgage	19.0	5.4	13.6	20.0	25.8	30.9
Owner outright	26.0	16.9	25.9	28.4	29.5	30.9
UK:						
Renters	35.6	48.4	49.7	36.7	24.6	14.0
Owner with mortgage	30.7	14.4	18.4	29.8	42.2	44.1
Owner outright	32.6	35.4	31.1	32.6	32.4	31.2
US:						
Renters	34.9	59.0	41.4	32.1	24.1	16.8
Owner with mortgage	40.3	15.6	29.3	42.2	53.7	61.4
Owner outright	22.9	21.4	26.8	24.1	21.1	21.2

Note: Missing from 100 %: other/not available. Source: OECD Affordable Housing Database, available at: `http://oe.cd/ahd`.

The rental market in Germany, which accounts for around 55% of households, is primarily a private rental market (Kemp and Kofner 2010). The share of dwellings in the social rents sector amounts to only 4% in 2014, similar to the U.S. share (4%), but much smaller than those in the UK (18%) or France (19%).[3] Dwellings in Germany's social housing sector are provided partly by private investors who receive subsidies if they let the dwelling at below-market rent for 20 years, after which the social housing units become part of the private rental market. Over the past years, the number of social housing units has decreased sharply, from 2.6 million in 2002 to 1.4 million in

[2] Among the reasons for low homeownership rates in Germany, Voigtländer (2009) points to post-WWII subsidies for social rental housing, the moderate rent regulation that made rental property provision attractive to private landlords, and subsidies for private landlords such as accelerated depreciation or tax deductibility of mortgage interest payments.

[3] See the OECD Affordable Housing Database, available at: `http://oe.cd/ahd`

2014 (Gedaschko 2016), with only about 3.5% of households living in the social housing sector by 2014. Likewise, the municipal housing sector, i.e. the stock of housing owned by municipalities, declined since the 1990s as several cities have privatized their housing stock that was provided for below-market rents (Held 2011).

Changes in Rental Prices. Across our entire period of study (1993–2013), rents for new contracts can be freely set by landlords, subject only to weak constraints, while rents for existing contracts must not be higher than comparable average rents in the local market and can only be raised by 20% over a three-year period.[4] There are exceptions, however, since additional costs for modernization investment can be partly shifted to renters.[5] Figure 2.1, Panel A shows real rental price indices for Germany, comparing indices of all rents and of rents for new contracts, deflated by the general consumer price index. Average rents increase by a total of 20% between 1991 and 2000. This rise is due partly to large rent increases in East Germany, whose pre-reunification rental market had been strictly regulated and which afterwards sees large housing investments to modernize its housing stock. Rents also increase in West Germany due to an increase in the demand for housing following East-to-West migration during the 1990s and the arrival of ethnic German immigrants.[6] This increase in rental prices slows down in the late 1990s, however, and average rents decline slightly in real terms during the 2000s. Nevertheless, rents for new contracts (the dashed line in the figure) strongly diverge from existing rental rates from 2010 onward and then increase by about 15% in real terms (or as much as 19% for city dwellers) up to 2016. This divergence between average rents and new contract rents is consistent with the German regulatory environment, where existing contract rents are more strongly regulated while new contract rents can be more freely adjusted. Correspondingly, sitting tenants benefit from a length of residency discount, and the burden of adjustment is shifted to new renters.

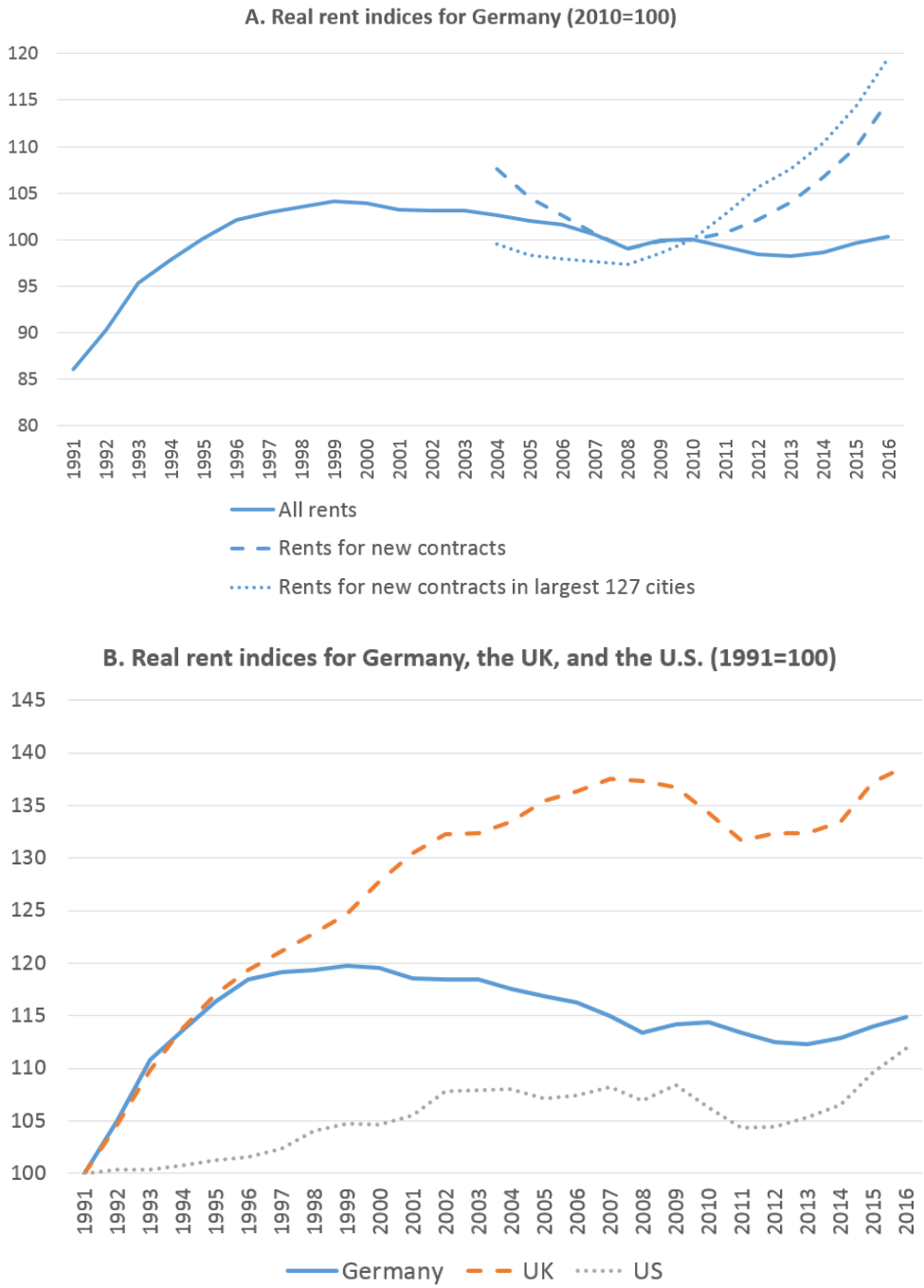
In Figure 2.1B, we compare the rent indices in Germany to those in the U.S. and the UK, normalized to 100 in 1991. Whereas the UK shows the strongest rent increase over the period considered (by 37% in real terms between 1991 and 2016), the 12% increase in the U.S. is lower than that in Germany (15%), with even the late 1990's and early 2000's U.S. housing boom inducing only a small increase in rental prices.

[4]Before 2001, this threshold is 30% (see also Fitzenberger and Fuchs 2017 and the literature cited therein).

[5]Specifically, up to 11% of the modernization costs paid by the landlord can be shifted to renters, and this rent increase is not restricted by the local average rent or by the 20% cap, which would otherwise limit rent increases for existing contracts.

[6]See also Frick and Grimm (2009) for a further analysis. Net migration from East to West Germany between 1991 and 2006 totals 1.45 million individuals (Fuchs-Schündeln et al. 2010), while ethnic Germans from the former Eastern block moving to Germany between 1987–2001 number 2.8 million (Glitz 2012).

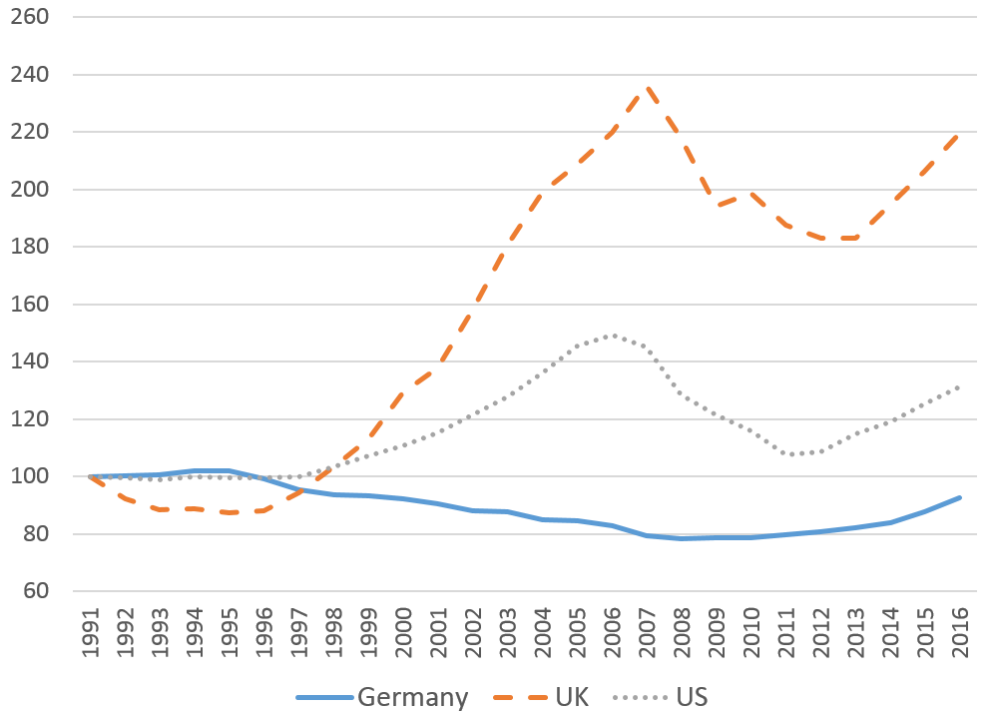
Figure 2.1: Real rent indices



Sources: Index for all rents: German Federal Statistical Office (2016). Index for rents for new contracts: BBSR (only available from 2004 onward). Index for rents in top 127 cities: Bundesbank. U.S. and UK indices come from the OECD Analytical house price indicators, available at: `https://stats.oecd.org/Index.aspx?DataSetCode=HOUSE_PRICES`. All indices are deflated using the CPI for each country.

Housing Prices and Mortgage Markets. As regards the development of real house price indices for Germany, the UK and the U.S., house prices in Germany stay flat in the early 1990s, fall in real terms from the late 1990s onward for the next decade, and rebound modestly after 2010 (Figure 2.2). This pattern is in sharp contrast to the U.S. and UK, where house prices increase dramatically from the mid-1990s until the Great Recession, decrease afterward until 2011 (the U.S.) and 2013 (UK), respectively, and then start to increase again. Hence, housing prices in the Anglo-Saxon countries not only show a stronger long-term upward trend but also tend to be more volatile than in Germany.[7]

Figure 2.2: Real house price indices (1991=100)

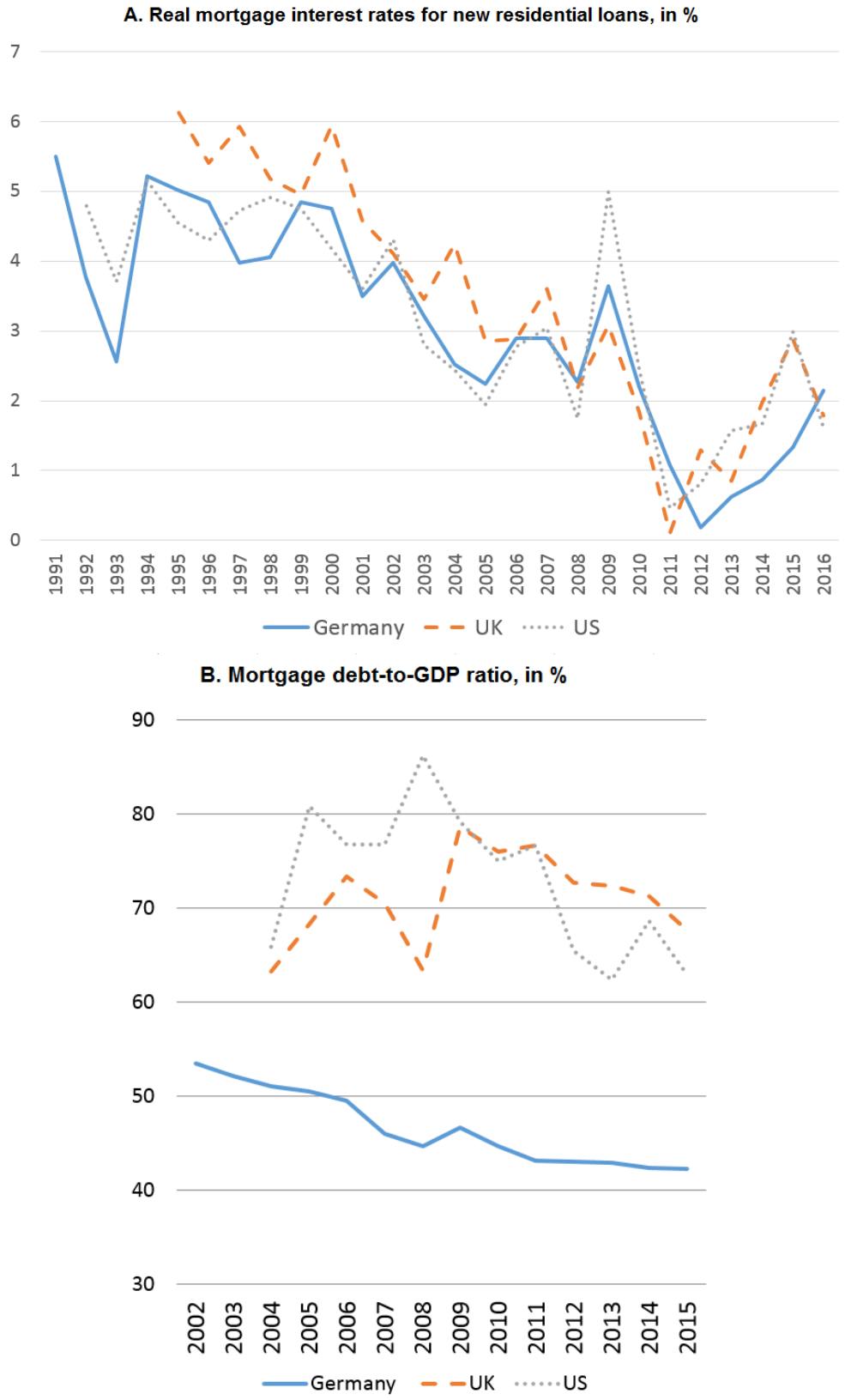


Sources: OECD Analytical house price indicators, available at: `https://stats.oecd.org/Index.aspx?DataSetCode=HOUSE_PRICES` House prices include prices for the sale of newly-built and existing dwellings. All indices are deflated using the CPI for each country.

Because mortgage rates, like house prices, are also an important determinant of housing expenditures for owner-occupiers, Figure 2.3A graphs the decreases in real interest rates for new mortgages since the early 1990s in all three countries, which all see rates of about 5% in the early 1990s fall to below 1% in 2011. These decreases accelerate across the board in the immediate aftermath of the financial crisis before rebounding slightly. Nonetheless, although mortgage rates

[7] See Knoll et al. (2017) for a comparative analysis of housing prices in various industrialized countries or Glaeser et al. (2008) for an analysis of housing price bubbles in the U.S.

Figure 2.3: Changes in mortgage interest rates and mortgage debt



Sources: German and UK interest rates are for five-year fixed rate mortgages, U.S. interest rates are for 15-year fixed rate mortgages. Data on interest rates come from the Association of German Pfandbrief Banks (Germany), Bank of England (UK), and the St. Louis Fed/Fannie Mae/Freddie Mac (US). All interest rates are converted to real rates using the CPI for each country. Data on mortgage debt and GDP come from the Hypostat (2015) report by the European Mortgage Federation.

follow similar trends in all three countries, the level of mortgage debt develops quite differently in Germany (see Figure 2.3B). Whereas the mortgage debt-to-GDP ratio decreases in Germany, it increases considerably in the Anglo-Saxon countries, with a 2015 mortgage debt to GDP ratio in Germany of about 42% compared to 63% in the U.S. and 68% in the UK. Hence, overall, the large reduction in interest rates does not lead to a large expansion of mortgage debt in Germany, resulting in a reduction in mortgage interest payments.

One obvious reason for these differences is the lower share of homeowners in Germany, resulting in lower demand for mortgage credit. This difference might also stem from the much stricter set of mortgage lending requirements in Germany. For example, German banks require higher down payments, such that the average share of equity financing in Germany in 2012 is 30% of the mortgage value, while it is just 15% in the UK (SVR 2013). Regulations also preclude a subprime lending market for households with low equity and unstable income, and mortgage equity withdrawal (borrowing against the mortgage value in expectation of rising house prices) is also uncommon.[8] Hence, mortgage holders in Germany are a select group whose wealth or income enable them to meet the required down payment, leading to individuals acquiring property relatively late in life.[9] These factors (as discussed in more detail below) affect the composition of homeowners and renters in terms of their position in the income distribution.

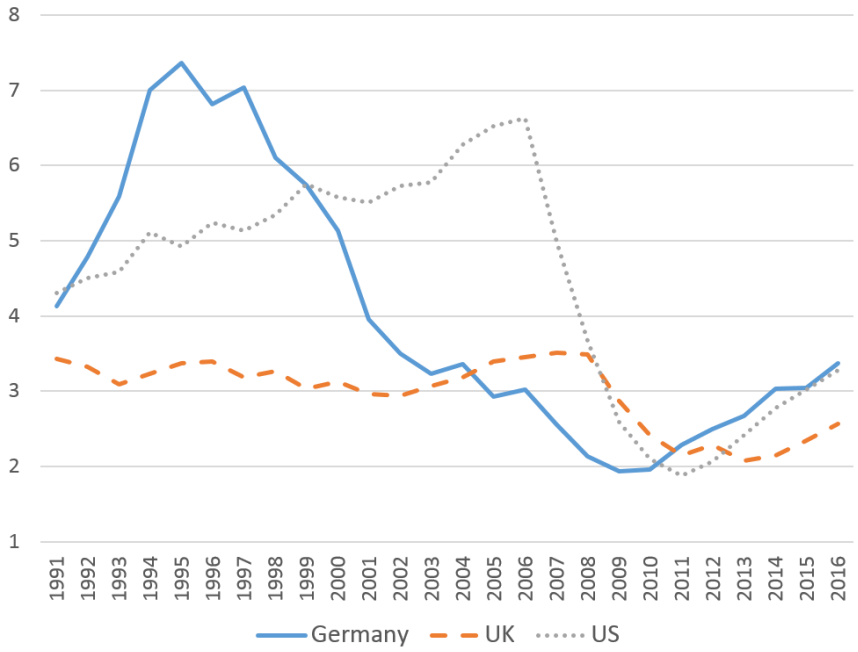
Residential Construction. Figure 2.4 compares the number of newly constructed housing units per 1,000 inhabitants across the three countries. Germany sees a construction boom after reunification, with about 4.2 million new flats built in West Germany between 1991 and 2000, and 1 million new flats in East Germany. This is driven by the modernization of the East German housing stock and the increased demand for housing space following East-West migration and the arrival of ethnic German immigrants. In the late 1990s and over much of the 2000s, however, construction slows down considerably, consistent with the flat rents and housing prices during this period (see Figures 2.1 and 2.2). Construction increases again after 2008. Meanwhile, in the U.S., construction increases strongly through the mid-2000s but declines sharply after the housing bubble burst. In the UK, construction remains flat throughout much of the 1990s and 2000s.

Demographic Changes. Several demographic changes in Germany are also likely to have had major effects on the housing market. First, as Figure 2.5 shows, average household size decreases from 2.27 in 1991 to 2.00 in 2015, which increases the demand for housing space per capita. Since households use fewer economies of scale in housing consumption, the housing expenditure burden increases over time for the individual. In the U.S. or UK, in contrast, households are larger on average and the decrease in household size occurs more slowly than in Germany.

[8] The expansion of the subprime mortgage market and the use of mortgage equity withdrawal played an important role in the housing price bubble and the increase in U.S. household debt after the 1990s (Mian and Sufi 2014).

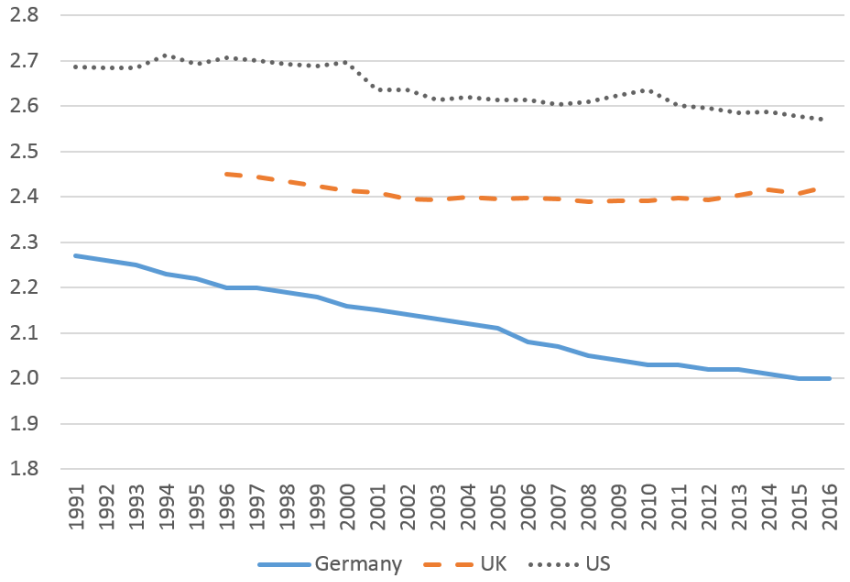
[9] Whereas many people in the UK buy several houses over a lifetime and "climb up the housing ladder," Germans typically buy only one house at a later age (Kemp and Kofner 2010).

Figure 2.4: Number of newly completed housing units, per 1,000 inhabitants



Sources: Germany: German Federal Statistical Office; UK: Office for National Statistics (population), Department for Communities and Local Government (new construction); U.S.: Census Bureau.

Figure 2.5: Average household size



Source: Germany: German Federal Statistical Office, UK: Office for National Statistics, U.S.: Census Bureau.

2.2.2 Data

Our main analysis is based on the 1993, 1998, 2003, 2008, and 2013 waves of the Income and Expenditure Survey (Einkommens- und Verbrauchsstichprobe, EVS), which is administered every five years by Germany's Federal Statistical Office to large repeated cross sections of households. The EVS serves as the basis for the consumption baskets used for official consumer price indices.[10] The data have three features that make them particularly well suited for our analysis: First, the sample size is large, with each wave of raw data covering between 96,000 and 128,000 individuals from 39,000 to 49,000 households. Second, the survey examines numerous categories of both income and expenditure in great detail, allowing us to study various dimensions of inequality. Third, the EVS differs from other household surveys (e.g., the SOEP) in its reliance on a consumption diary kept for (at least) one quarter rather than on retrospective survey questions. This continuous measurement over a relatively long period results in higher data accuracy.[11] More details on the data used can be found in Appendix 2A.

Our main analysis focuses on working age individuals between 20 and 60. We consider all households with at least one individual in that age range and then form a sample of individuals in the age range based on the information of the corresponding household. We also verify certain of our key results using other age ranges (see Appendix 2A). We exclude from the sample any individual who reports a negative or zero net household income or a share of housing expenditures, non-housing expenditures, or savings relative to net household income that is above two or below minus two. The final number of individuals (households) is 59,195 (32,268) in 1993, 70,522 (39,325) in 1998, 70,792 (39,895) in 2003, 69,355 (40,036) in 2008, and 60,743 (36,903) in 2013.

Throughout the paper, we consider income from various sources measured at the household level and equivalized to adjust for household size differences by dividing household income by the number of equivalent adults in the household and assigning the outcome equally to all household members.[12] We use the same method to make consumption expenditures – in particular housing expenditures – and savings comparable with income. We then calculate all inequality measures and other statistics at the individual level, converting all monetary values to 2010 euros using the Federal Statistical Office's consumer price index (CPI).[13]

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[10] For detailed data documentation, see Federal Statistical Office (2005a, 2005b, 2012, 2016).

[11] The period of recordkeeping in the EVS of 3 months is far longer than that the diary in other consumption surveys. For instance, the Consumer Expenditure (CE) Survey in the US and the Living Costs and Food Survey (LCF) in the UK keep diaries for up to only two weeks. Bee et al. (2015) argue that infrequently purchased goods are not captured well by the two-week diary in the CE. The main housing expenditures we study (i.e., rent, energy, and mortgage payments) typically occur on a monthly basis and so should be well captured by the EVS.

[12] We use the new OECD equivalence scale, which assigns a weight of 1 for the first adult in the household, 0.5 for each additional household member aged 14 and above, and 0.3 for each additional household member under 14. The same scale is used e.g. in Biewen and Juhasz (2012) for Germany, as well as Attanasio and Pistaferri (2016) for the U.S. Alternative equivalence scales are investigated in Appendix 2A.

[13] Because consumer prices rose much faster in East Germany than in West Germany following reunification, until 1999, the Federal Statistical Office published separate price indices for the two. We therefore use West and East

Some of our analyses also rely on the yearly German Socio-Economic Panel (SOEP), a yearly household panel (see Wagner et al. 2007). The SOEP provides a more detailed set of housing characteristics (e.g., whether the dwelling is in the social or public housing sector), as well as the longitudinal information used in the Section 2.5.1 analysis on permanent versus transitory inequality. We thus also compare EVS and SOEP outcomes to check whether both data sets give a consistent picture of the key trends in inequality and expenditures.

2.3 Income Inequality and Housing Expenditures

2.3.1 Income Inequality

In line with the inequality literature (see e.g., Blundell and Etheridge 2010 for the UK, Attanasio and Pistaferri 2016 for the U.S., and Biewen and Juhasz 2012 for Germany), the key income concept considered in our analysis is equivalized net household income. This variable is defined as the sum of a household's labor income (from both dependent employment and self-employment of all household members), capital income, non-public transfer income, and public transfer income minus tax payments and social security contributions, equivalized and distributed to all household members (see Section 2.2.2).

In Figure 2.6, we show the growth of equivalized net household income at various percentiles of the distribution, indexing the percentiles to be zero in 1993 and giving all numbers in real terms. The bottom of the income distribution is characterized by a sharp drop and the top by an increase, while the median remains largely unchanged. Over the 1993–2008 period, real income growth is -2% at the median, -11% at the 10th percentile, and +3% at the 90th percentile. During the 2008–2013 period of high growth and declining unemployment, in contrast, real incomes increase at all percentiles. The cumulative real income change between 1993 and 2013 was thus -10% at the 10th percentile, +2% at the median, and +7% at the 90th percentile.

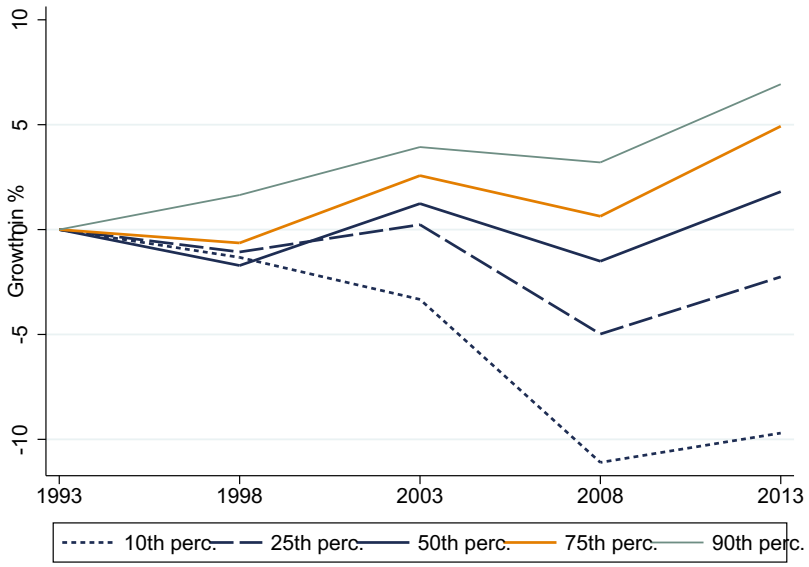
Figure 2.7 then illustrates the percent real growth of equivalized net household income along the income distribution. From 1993 to 2003, income declines below the 25th percentile then grows modestly between the 25th and 90th percentile but increases sharply above the 90th percentile. From 2003 to 2013, in contrast, interpercentile differences increase more sharply below the 80th percentile, with a drop in income below the 45th percentile, and a rise further up the distribution. Above the 80th percentile, there is no further increase in dispersion.

2.3.2 Housing Expenditures

We next investigate the development of housing and other expenditures, and how it differs between income groups. Consistent with our income measure, we compute expenditures at the household

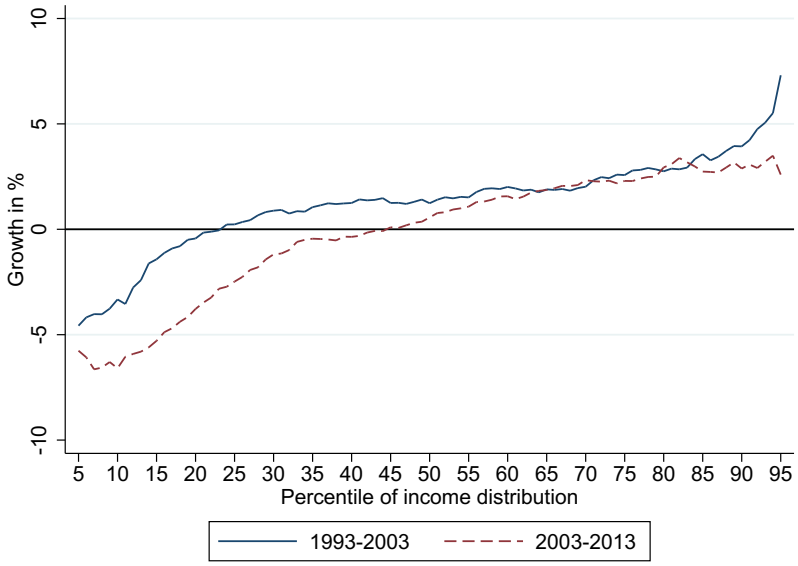
Germany specific CPIs for the 1993 and 1998 waves.

Figure 2.6: Cumulative real growth of equivalized net household income, relative to 1993



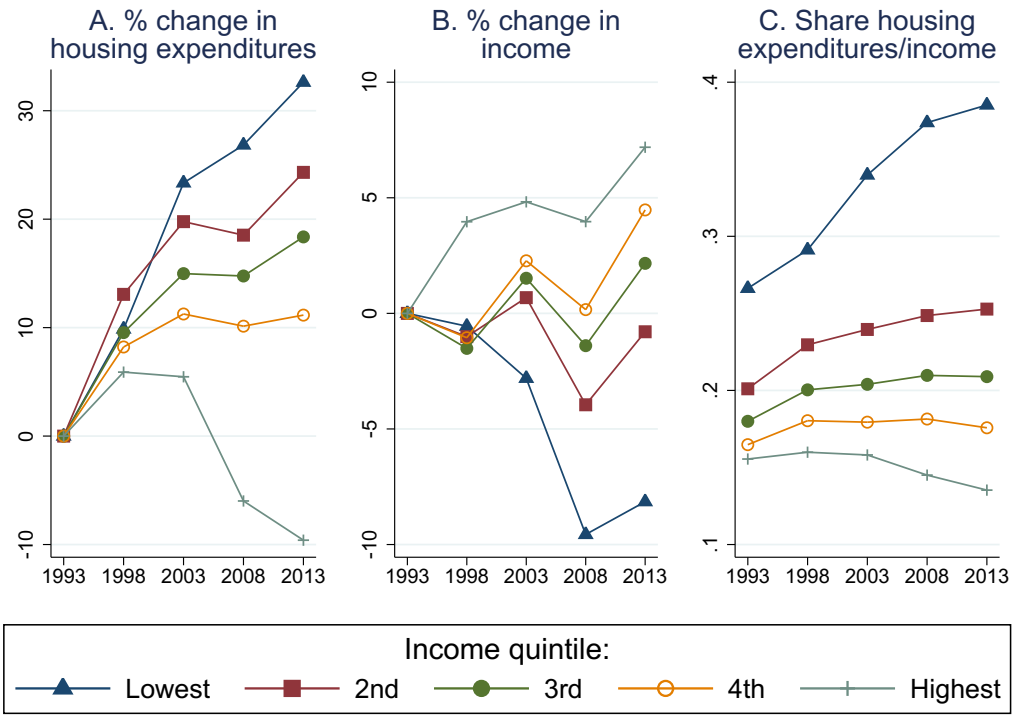
Note: Net household income is the sum of labour income, capital income, private and public transfers, minus taxes and social security contributions. Household income is divided through the number of equivalent adults in the households (using the modified OECD equivalence scale) and assigned equally to all household members. The sample consists of individuals age 20-60. Source: EVS, author calculations.

Figure 2.7: Percent real growth in equivalized net household income, by percentile



Note: Further definitions see Graph 2.6. Source: EVS, author calculations.

Figure 2.8: Housing expenditures and income, by income quintile



Note: Housing expenditures for renters include basic rent (including utilities such as water and waste charges) and energy costs, while housing expenditures for owner-occupiers are mortgage interest payments, energy costs, as well as maintenance and operating costs. Income refers to net household income, i.e. the sum of labour income, capital income, private and public transfers, minus taxes and social security contributions. Both housing expenditures and household income are equivalized using the modified OECD equivalence scale and assigned equally to all household members. The sample consists of individuals age 20-60. Source: EVS, author calculations.

level and then divide them by the number of equivalent adults in the household to construct equivalized individual expenditure measures. The unit of analysis is the individual, and the sample includes all individuals aged 20-60. Following Belfield et al. (2015), we define housing expenditures for *renters* as the basic rent (including utilities such as water and waste charges) and energy costs, and housing expenditures for *owner-occupiers* as mortgage interest payments, energy costs, and maintenance and operating costs.[14]

In Figure 2.8, which traces the 1993-2013 development of housing expenditures across income groups both in absolute terms and relative to income, the left-hand panel shows about a 32% increase in mean housing expenditures for individuals in the lowest income quintile, but a 9% decline for those in the highest. The middle panel, which displays the change in real income,

[14]Because repayment of mortgage capital constitutes an accumulation of net wealth and is thus part of savings rather than consumption, we include only mortgage interest payments in regular housing expenditures.

clearly illustrates the sharp increase in income inequality and the decline of real incomes in the lowest quintile, thereby mirroring the results in Section 2.3.1. Thus, while the sharp increase in housing expenditures is accompanied by a large decrease in income for the lowest quintile of the income distribution, the highest quintile sees an increase in income and a fall in housing expenditures.

As the figure's right-hand panel illustrates, these trends lead in turn to a sharp increase in the share of household income spent on housing in the lowest income quintile, more modest increases in income quintiles further up the distribution, and a drop in the highest income quintile. For the lowest income quintile, this share increases from 27% in 1993 to 39% in 2013, with the steepest rise between 1993 and 2008, and a flattening out between 2008 and 2013. For the top income quintile, in contrast, the share of income spent on housing declines from about 16% in 1993 to 14% in 2013.

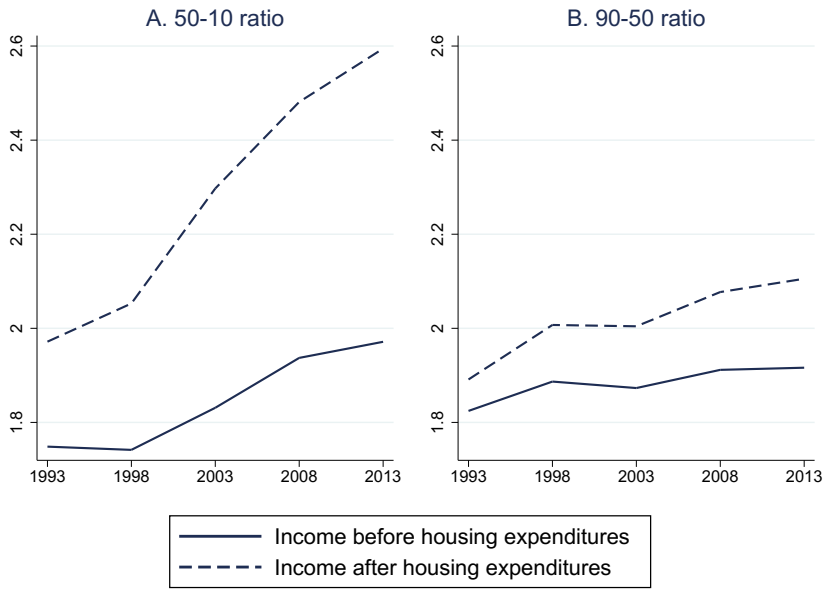
In Figure 2.9, we compare two inequality measures (the ratio of the 50th to the 10th percentile and the ratio of the 90th to the 50th percentile) for two concepts of net household income – before and after deduction of housing expenditures, respectively, with the former income concept as the focus of most inequality analyses (see Section 2.3.1). As the figure illustrates, the level of income inequality becomes much larger once housing expenditures are accounted for (in particular the 50/10 ratio). What is more remarkable is the divergence of these two income concepts over time. Between 1993 and 2013, the 50/10 ratio of income before housing expenditures increases from 1.75 to 1.97 (by 22 pp), while the 50/10 ratio of income net of housing expenditures increases from 1.97 to 2.59 (by 62 pp), meaning an almost triple change once housing expenditures are taken into account. The 90/50 ratio also shows a stronger increase over time after housing expenditures are accounted for, but the difference is smaller than its 50/10 counterpart.

We turn next to the share of household income spent on housing expenditures, non-housing expenditures, and on savings (Figure 2.10).[15] The changes over time are particularly salient for individuals in the bottom income quintile, whose share of housing expenditures increases from 27% in 1993 to 39% in 2013, while the share of non-housing expenditures increase from 72% to 63% and the share of savings decreases from 2% to -1%.[16] Further analyses (not shown here) reveal that the share of individuals in the bottom quintile with positive savings falls from 64% to 53%. In contrast, the other income groups see less dramatic changes in their consumption and savings patterns.

[15] We define the components as follows: housing expenditures (as discussed above) includes rent, mortgage interest, maintenance and operating costs, and energy costs; other expenditures include 10 categories of consumption expenditures (beverages, food, furniture, health, transport, information/communication, leisure/entertainment, education, eating out, and other goods and services), as well as non-consumption expenditures (insurance premiums, credit interest payments excluding mortgage interest, charitable contributions, private transfers made, and other items).

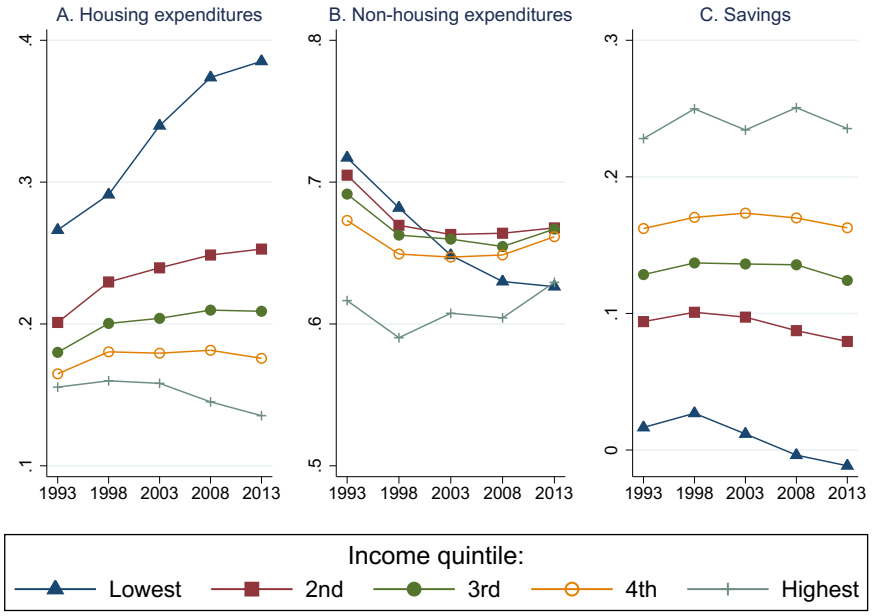
[16] Among the different non-housing expenditure items, the biggest drop for the lowest income quintile is in food expenditures (by about 5 pp), although most other consumption items (e.g., clothes, transport) also decrease.

Figure 2.9: Inequality of equivalized net household income – before and after housing expenditures



Note: Incomes and housing expenditures are defined as in Figure 2.8. Source: EVS, author calculations.

Figure 2.10: Expenditure shares by quintile of equivalized net household income



Note: Incomes and housing expenditures are defined as in Figure 2.8. Source: EVS, author calculations.

Finally, to examine the comparability of our two data sets, in Appendix 2A we use the SOEP data to replicate the previous findings from the EVS. The results for both data sets document the same key trends: rising inequality of equivalized net household incomes and a rising share of income spent on housing by low-income groups.

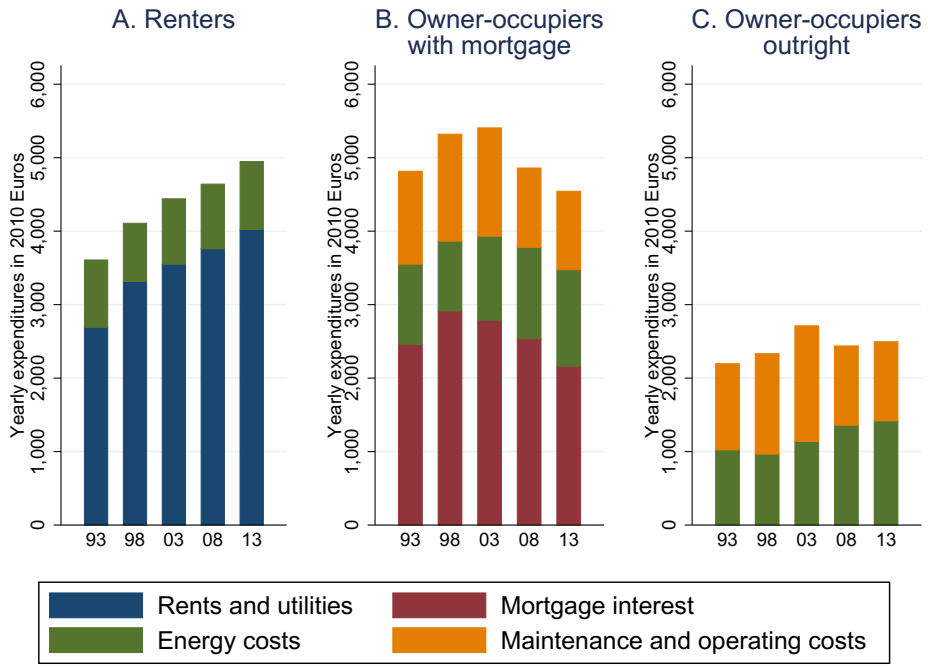
2.4 Explaining Inequality Trends

Given the above evidence of a considerable divergence in housing expenditure shares between income groups, we now explore several factors that may contribute to this trend.

2.4.1 Housing Expenditures for Renters and Owner -occupiers

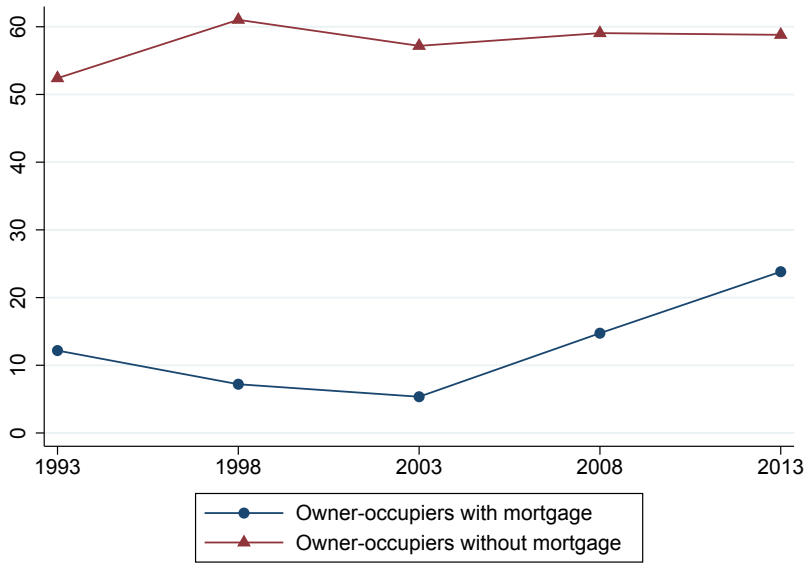
Because homeownership rates vary across the income distribution, a divergence in housing expenditures for renters versus owner-occupiers leads to a corresponding divergence in after-housing income. We illustrate this divergence in Figure 2.11 using the different housing expenditure components (in 2010 euros) for renters and owner-occupiers with and without outstanding mortgages. For renters, housing expenditures increase sharply between 1993 and 1998 before rising at a slower pace in subsequent years, resulting in about a 36% cumulative increase (from 3,600 € to 4,900

Figure 2.11: Components of equivalized housing expenditures, by type of house tenure



Note: Housing expenditures are on a yearly basis in 2010 Euros and equivalized using the modified OECD scale. Source: EVS, author calculations.

Figure 2.12: Median relative net imputed rents (NIR) for owner-occupiers, in percent



Note: NIR are calculated by imputing rent expenditures based on owners' characteristics and then deducing owners' actual housing expenditures. Relative NIR are in % of actual housing expenditures. Source: EVS, author calculations.

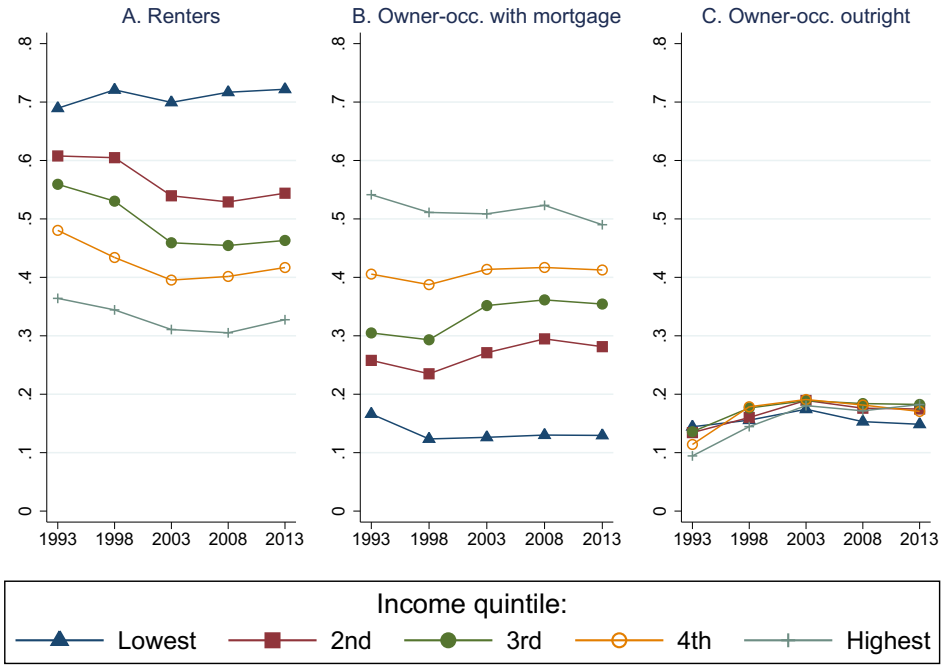
€) between 1993 and 2013. For homeowners who own outright, expenditures also increase, but only by around 14% between 1993 and 2013. In contrast, for owner-occupiers with an outstanding mortgage, housing expenditures increase between 1993 and 2003 at a slower pace than for renters and decrease substantially from 2003 onward leading to an overall 1993-2013 decline by 4% (from 4,800 € to 4,600 €). This decrease in the latter period is the result of falling mortgage interest payments, and falling construction rates across the 2000s that lead to a maturing housing stock with fewer outstanding mortgages (Figure 2.4). In particular mortgage holders aged 45 and over benefit from falling interest rates and from a maturing housing stock (see Appendix Figure 2.B1).

To compare the relative costs of renting versus owning, holding constant housing characteristics, we estimate net imputed rents (NIR). These are defined as the counterfactual housing expenditures for owner-occupiers if the dwelling were rented instead of owned minus the actual housing expenditures (Frick and Grabka 2003).[17] For renters, NIR is zero by definition, while a positive (negative) NIR indicates that an owner-occupier pays less (more) than a renter for a comparable dwelling. We calculate the *relative* NIR by dividing the NIR by the owners' hypothetical rent ex-

[17]To calculate the NIR, we estimate hedonic regressions of housing expenditures for renters on a set of housing and household characteristics and impute the rent for owner-occupiers based on their characteristics. We then deduct the owners' actual housing expenditures (mortgage interest payments, maintenance and operating costs). Finally, we predict the conditional distribution of housing expenditures by covariates using quantile regressions and aggregate up to the overall distribution (see Appendix 2B for details).

penditure. Tracing the evolution of the median relative NIR over time for owners with and without a mortgage (Figure 2.12), we show that the NIR is positive for both groups in all years, meaning that owners pay less than renters for a dwelling of comparable quality. For owners with mortgages, the median relative NIR was 12% in 1993 but increases to 24% in 2013, indicating that in the last year of the observation period they pay 24% less than they would have paid to rent a similar dwelling. The sharp increase, especially between 2003 and 2013, reflects the fact that owners with mortgages could benefit from declining interest rates, as well as from the aging housing stock produced by declining housing construction over time. For owners without outstanding mortgage, the level of median NIR is naturally much higher, and also increases from 52% in 1993 to 58% in 2013. Hence, our figures overall show a falling cost of homeownership relative to renting over time.[18]

Figure 2.13: Share of tenure types, by quintile of equivalized net household income



Note: Incomes are defined as in Figure 2.8. Source: EVS, author calculations.

When we break down the shares of the three tenure types by income quintile (Figure 2.13), around 70% of the individuals in the lowest quintile are renters, leaving only a few owner-occupiers

[18] Schier and Voigtländer (2015) also document a falling cost of homeownership versus renting in Germany, although their analysis does not begin until 2008. Moreover, Hiebert and Sydow (2011) in a comparison between Germany and other major euro-area countries (Belgium, Ireland, Spain, France, Italy, the Netherlands, and Finland), pinpoint Germany as the only country in which the ratio of rents to house prices has increased since the mid-1990s while decreasing in the other countries.

with a mortgage, while in the top income quintile, only about one third are renters and around half are owner-occupiers with a mortgage. On the other hand, the share of owner-occupiers who own their homes outright is similar in all income groups. From 1993 to 2003, however, the share of renters declines in almost all income quintiles, while the share of owner-occupiers rises, with the one exception of the lowest income quintile, in which the trends are reversed.[19] Possible explanations for why homeownership do not increase among the bottom quintile are the decline in real income making homeownership less affordable as well as other demographic trends among the low-income population (in particular, rising shares of single households and city dwellers, as discussed in the next section).

Nevertheless, overall, it is remarkable that the falling interest rates from the early to mid-2000s onward do not lead to higher homeownership rates. Rather, according to Figure 2.13, during the 2000s, the share of renters increases slightly across all income groups. One hypothesis is that the German banks' conservative lending policies restrict mortgage access to households with sufficiently high income and the savings to afford a sizeable down payment, suggesting that most individuals in the lowest income groups are unable to benefit from falling mortgage interest rates and rising net imputed rents.[20]

2.4.2 Changes in Housing and Household Characteristics

Household Size and Demographics. One important factor driving housing expenditures is household structure. In the German case (see Figure 2.14, Panel A), the share of individuals living in single households increases over the 1993-2013 period – in particular among the bottom income quintile, where it increases from 23% to 42%.[21] This trend toward smaller households means that individuals are less able to use economies of scale in housing consumption, which increases the share of their budget to be spent on housing.

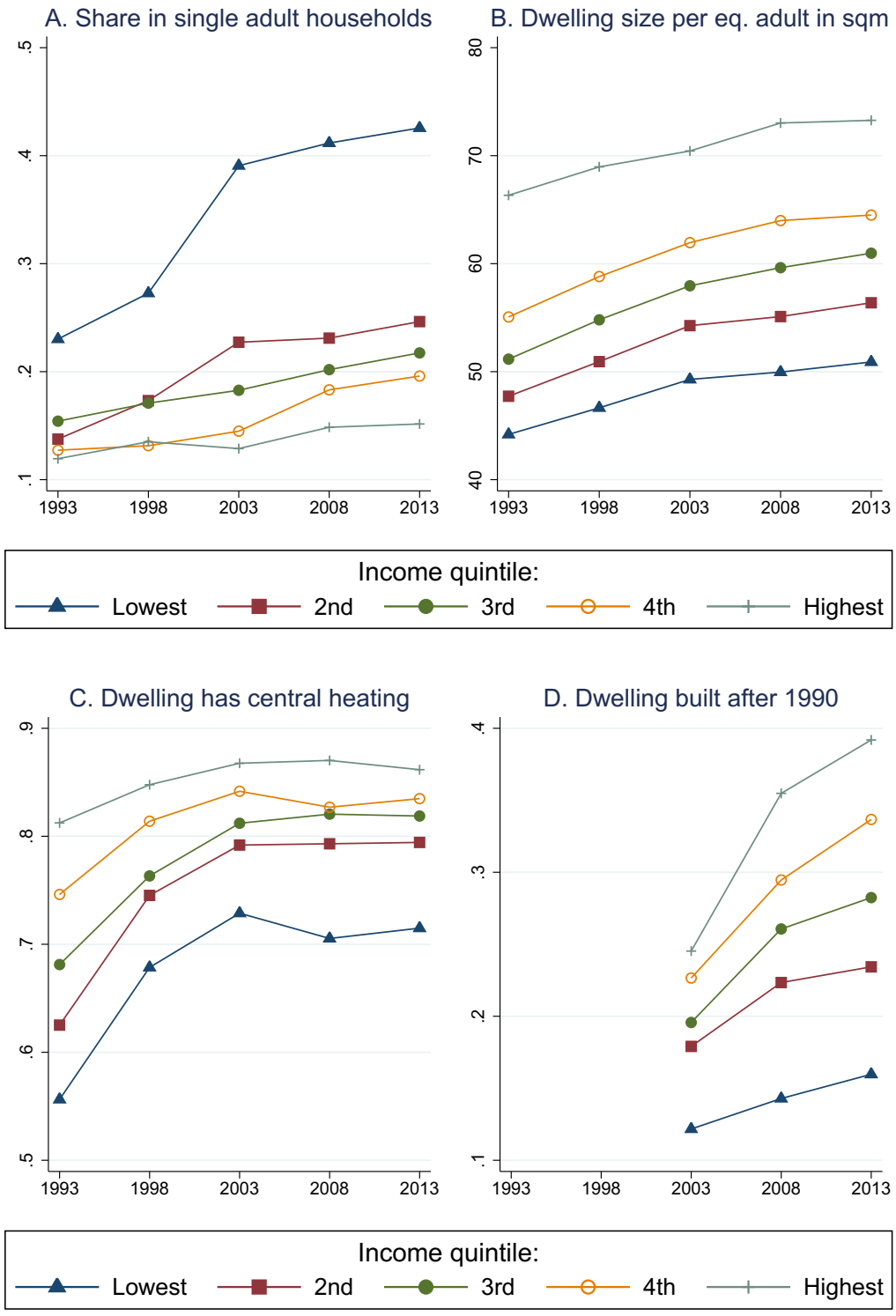
Dwelling Size and Quality. The living space per equivalent adult increases for all income groups (Figure 2.14, Panel B) but especially among the middle class. Therefore, the rise in housing space fails to explain the disproportionate increase in housing expenditures within the lowest quintile. Moreover, during the 1990s, the lower income groups enjoy the highest increase in the share of dwellings with central heating (Figure 2.14, Panel C), although the share of individuals living in relatively new dwellings (built in 1990 and after, Figure 2.14, Panel D) increases more

[19] This 1990's increase in homeownership is driven mostly by East Germans, who had very low homeownership rates during the GDR era. Hence, whereas the share of renters in West Germany only decreased from 47% to 46% between 1993 and 2003, in East Germany, it fell from 79% to 57%.

[20] The stricter lending requirements in Germany (SVR 2013, Voigtländer 2014), which are a distinguishing feature to the U.S. or the UK, result in lower homeownership rates, especially at the bottom of the income distribution.

[21] This increase includes single adults with and without children: In the bottom income quintile, the share of single adults without children increases from 16% to 33%, while the share of single adults with children increases from 6% to 9%.

Figure 2.14: Housing conditions, by quintile of equivalized net household income



Note: Incomes are defined as in Figure 2.8. Source: EVS, author calculations.

for the top quintiles.[22]

These observations raise the question of to what extent quality improvements are demand driven (i.e., by the household choice to consume more or better living space) versus supply driven (i.e., by a changing housing stock induced partly by government regulations). If the quality improvement is caused by the latter, it is not welfare enhancing for low-income households but may rather reduce welfare through a loss in disposable income after housing (see Quigley and Raphael 2004 for this argument). In fact, supply-side factors are likely to have played a role in the 1990's housing construction boom, made possible in part by government subsidies for private investment in modernization and new construction. Moreover, the prevailing rent regulation incentivizes modernization, since costs of housing modernization investment can partly be shifted to renters, and landlords can thus circumvent the stricter regulation of existing rent contracts. Not only may this new construction and modernization have made it harder for low-income households to find smaller and cheaper flats even when they wanted to, but patterns of new housing stock construction may have adapted only slowly to changing household structures such as the rise in single households.

Regional Migration Patterns. In Figure 2.15, we show the income spent on housing by those in the lowest income quintile in West and East Germany across different community sizes, defining the quintile at the Germany-wide level. Individuals in the lowest income quintile living in large cities spend a much larger share of their income on housing than those living in smaller municipalities (about 10 pp more). However, the increase in the income share spent on housing over time is evident across all size categories and not limited to large cities.

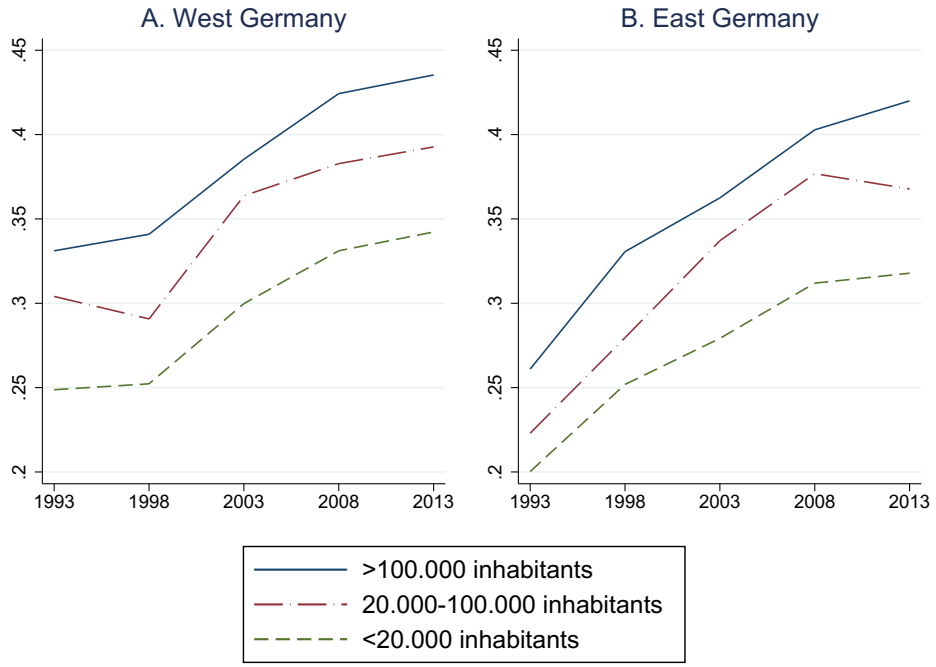
We then consider how different income groups are located across regions and how regional mobility has changed over time. As Figure 2.16 shows, individuals in the lowest income quintile disproportionately relocate to West Germany and larger cities, both of which have higher housing costs. During the 1990s (a time of considerable migration flows from East to West Germany), the share of individuals in the bottom income quintile who live in West Germany increases from 65% to 73%, while the share of those living in cities with over 100,000 inhabitants increases from 32% in 1993 to 42% in 2013. For other income groups, the share living in large cities falls from 1993 to 2003 but then rises again from 2003 onward.[23] Evidence also exists for increasing residency polarization over time; that is, in 2013 individuals in both the bottom and the top quintiles are more likely to live in large cities than those in the middle of the distribution.

These findings on rural-urban mobility suggest that those at the bottom of the income distribution are at least as likely to move to cities as those who are better off, and that changes in

[22]This variable is only available in the data from 2003 onward.

[23]These findings relate to the analysis by Kemper (2009) who characterizes the late 1990s as a period of "suburbanization" followed by a period of "reurbanization" during the 2000s. However, he doesn't distinguish between different income groups.

Figure 2.15: Regional differences in the share of income spent on housing, for lowest income quintile

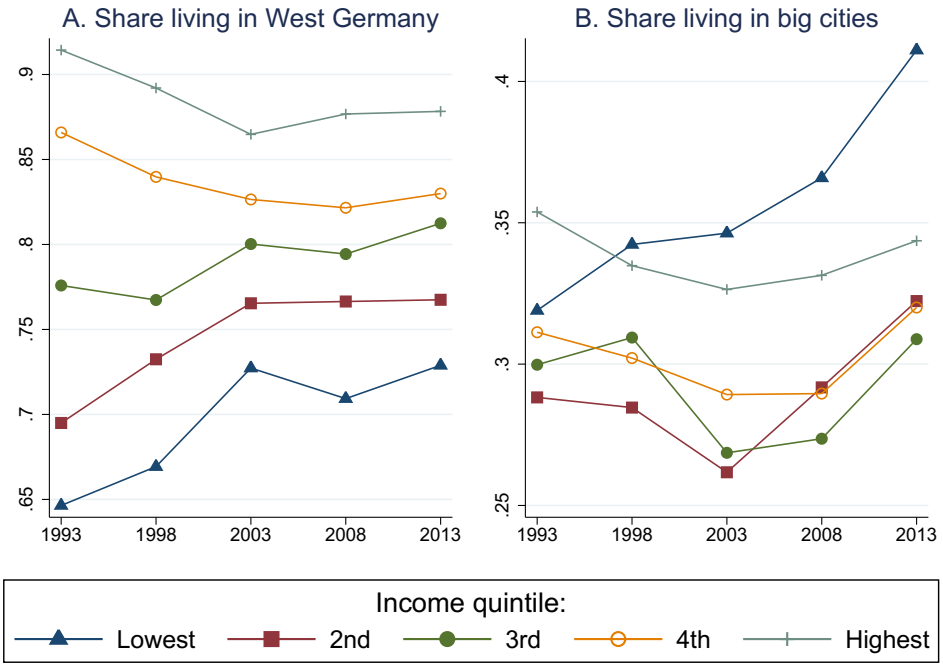


Note: Incomes are defined as in Figure 2.8. Source: EVS, author calculations.

the regional allocation of the population do not compensate for the increase in nominal income inequality. These conclusions seemingly contrast with Moretti's (2013) finding for the U.S. that during 1980–2000, college-educated workers increasingly move to more expensive cities where they face larger increases in housing costs. Although Moretti argues that this finding explains about one quarter of the increase in the nominal wage difference between college and non-college workers, he also admits that these stark effects are limited to the college/non-college gap, while the 90/50 and 50/10 wage gaps are little affected by changes in the regional costs of living. These latter measures are more closely related to our analysis. Still, we undertake a detailed comparison with Moretti (2013) by repeating our analysis using skill groups (see Appendix 2C for detailed results). As Figure 2.C1 shows, both high-skilled and low-skilled individuals are more likely to live in large cities than medium-skilled individuals, and the increase over time is higher for both high- and low-skilled.

We then use information on regional price differences to assess how they affect both general inequality and inequality between skill groups (see Appendix 2C for details of the regional CPI). According to Appendix Table 2.C2, the levels of the 50/10 ratio and 90/50 ratio in equivalized net household incomes are barely affected when regional price differences are accounted for. In line with the regional migration patterns described above, the increase in the 50/10 ratio over

Figure 2.16: Regional distribution, by quintile of equivalized net household income



Note: Incomes are defined as in Figure 2.8. Big cities are cities with 100.000 or more inhabitants. Source: EVS, author calculations.

time becomes stronger (+23 pp instead of +22 pp between 1993-2013), but the magnitude of the change is small. Furthermore, following Moretti (2013), we also analyze whether trends in wage inequality and skill premia (based on German administrative Social Security data) are reduced when accounting for regional price differences (see Appendix Tables 2.C3 and 2.C4).[24] Although controlling for regional price differences reduces the level of inequality slightly (particularly the high-skill vs. medium-skill gap given that college-educated workers are more likely to live in cities), the *increase* in inequality in real wages for both overall wages and skill wage premia is virtually the same irrespective of whether wages are deflated by different regional price indices.

Moretti (2013) argues that the welfare consequences of regional mobility depend on whether it is driven by labor market conditions or by movers' preferences for amenities in cities.[25] Here, we use SOEP data which have the advantage of including direct information on the main motives for the respondents' last residential move. As Table 2.2 shows, among those in the lowest quintile

[24]The data used are from the Sample of Integrated Employment Biographies (SIAB), with wage findings based on full-time workers aged 20-60, and estimated skill wage premia based on regressions of log wages on education (low/medium/high), experience, experience squared, age, age-squared, and dummies for gender and German citizenship.

[25]In a replication of Moretti (2013), Diamond (2016) argues that changes in amenities compensate high-skilled individuals for higher city housing costs.

Table 2.2: Reasons for residential moves, in percentages

	Lowest income quintile		2nd-4th income quintiles		Highest income quintile	
	Rural-to-city moves	Other moves	Rural-to-city moves	Other moves	Rural-to-city moves	Other moves
Job reasons	35.0	10.7	37.8	9.6	36.7	13.1
Family reasons	40.2	40.3	40.7	35.1	36.2	30.8
Old dwelling too small/too big	11.8	32.9	13.9	31.4	16.9	23.4
Bought own home	1.3	3.9	2.5	15.4	5.3	25.5
Other reasons	11.7	12.1	5.2	8.6	4.6	7.2

Note: The numbers in the table are based on the survey question: "What was the main reason for your last residential move?" Incomes are defined as in Figure 2.8. Source: SOEP, author calculations.

who recently moved from a rural area to a city, 35% cite job related reasons for the move. Among those that had made other moves (not from rural areas to cities), only 11% cite job related reasons. Results are similar for movers in other quintiles. Appendix Table 2.C1 also shows that rural-to-city moves in all skill groups are more strongly driven by job-related reasons. Overall, therefore, job-related reasons are key drivers for rural-to-city moves.

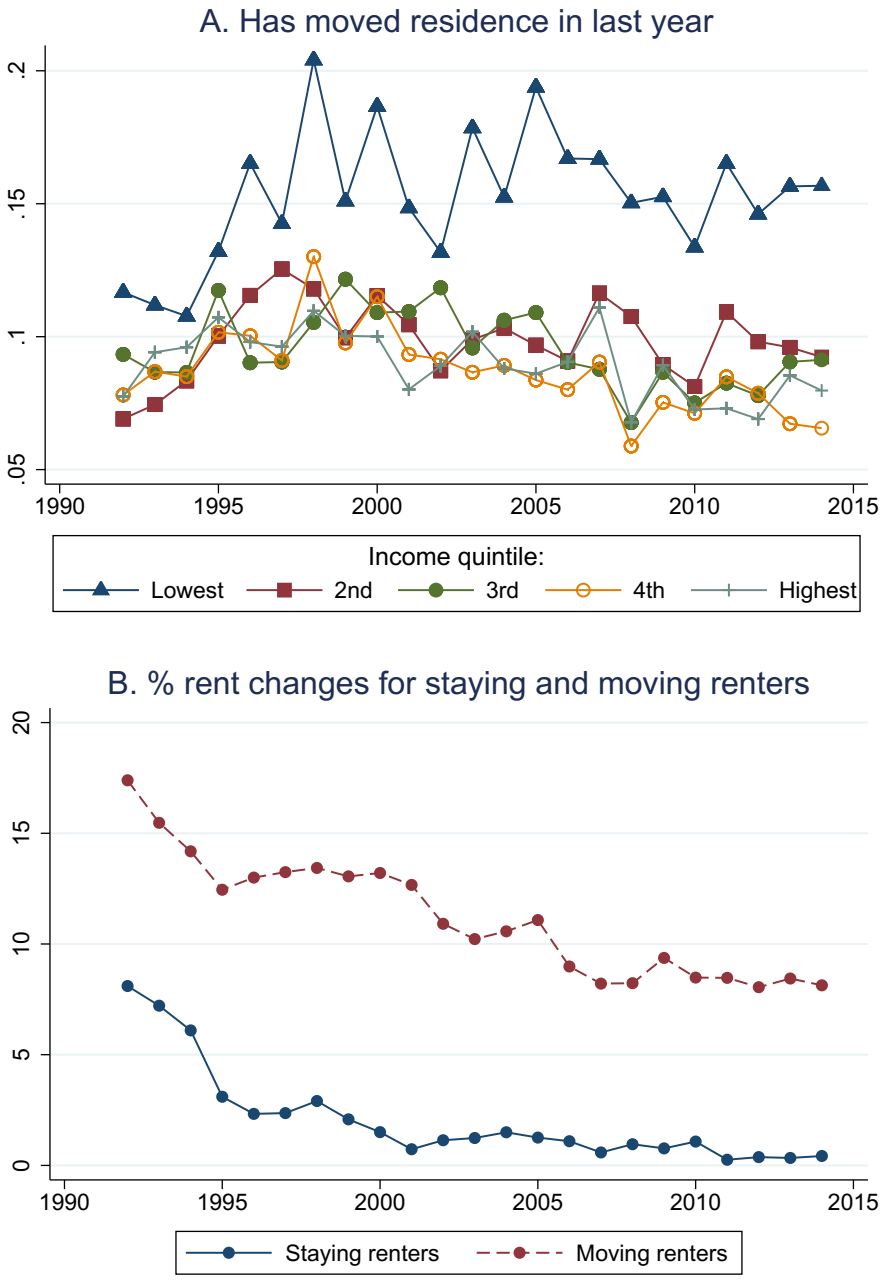
Costs of Residential Mobility. In addition to housing expenditures being higher in more urban areas, residential mobility *per se* involves costs for those who rent their home.[26] This is because during the period considered, rents for new contracts are freely negotiable, while rents for existing contracts are tied to the average local rent and can only be raised by up to 20% within any three-year period (see Fitzenberger and Fuchs 2017 and the literature cited therein). In fact, rent increases are far higher for movers than for stayers in all years, with the difference being particularly large during the 1990s (Figure 2.17, Panel B).[27]

Individuals in the lowest income quintile by far show the highest level of residential mobility (Figure 2.17, Panel A), which increase even further during the 1990s, making this group most vulnerable with regard to rent increases associated with a new lease. In contrast, homeownership rates are higher, and residential mobility is lower among high-income individuals, who are therefore affected much less by the strong rent increases for new leases. We conclude that residential

[26] Although the U.S. literature typically focuses on mobility costs for homeowners only (see e.g., Bricker and Bucks 2016, Andersson and Mayock 2014, Ferreira et al. 2010), in the German context, in which a large part of the population and most low-income individuals rent, an analysis of mobility costs for renters is very important.

[27] In further analyses (available upon request), we also estimate the discount in rent for an additional year of residency length, both unconditionally and after regression adjustment for rental unit characteristics. The adjusted discount is slightly smaller in magnitude since dwellings with higher residency length also tend to be older and of lower quality. The conditional discount is larger in the 1990s (up to -0.8% per additional year of residency) with a particularly strong increase in new contract rents during that period. By the 2000s, however, the discount leveled off to around -0.4% per additional year of residency.

Figure 2.17: Changes in residential mobility



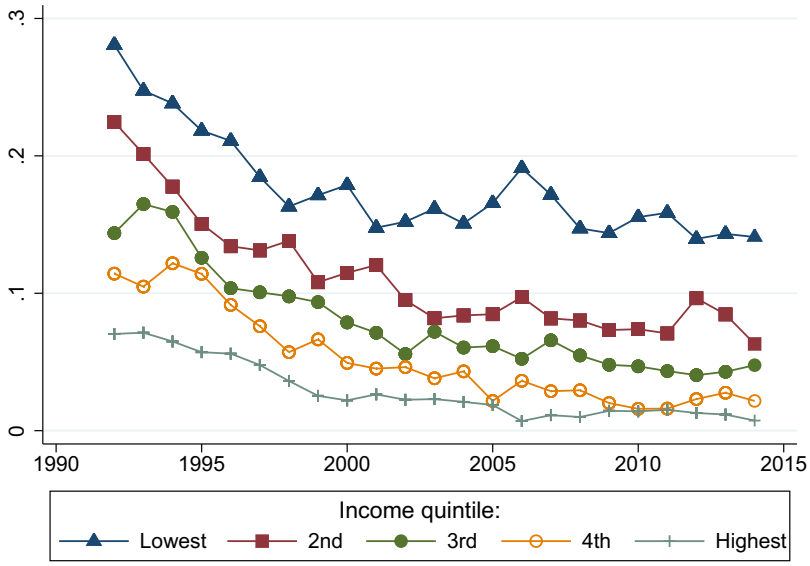
Note: Incomes are defined as in Figure 2.8. Source: German Socio-Economic Panel (SOEP), author calculations.

mobility is a likely contributor to rising inequality in income net of housing expenditures.

Provision of Social and Municipal Housing. Many dwellings in the social housing sector are provided by private investors who receive public subsidies if they let the dwelling at a below-market rent. These requirements to keep rents low typically expire after 20 years, after which social housing units lose their status and become part of the general private rental market. For many existing social housing units, this status expires during our observation period with few new units added (Gedaschko 2016). Likewise, municipal housing, owned or co-owned by city governments to provide housing for below-market rent, shrinks as municipalities increasingly privatize their housing stock to consolidate their budgets (Held 2011).

This strong decline in social and municipal housing between 1993 and 2003 is clearly illustrated by Figure 2.18, which shows the share of individuals in the lowest quintile living in social or municipal housing declining from about 29% in 1993 to 15% in 2013. The share of individuals living in social and municipal housing is highest for the lowest income quintile, although there is a strong decline until the mid-2000s for all income quintiles. Nonetheless, the share is much lower for higher income quintiles and by 2013 lies much below 10% for the second lowest to the highest quantile.[28]

Figure 2.18: Share of individuals in social/municipal rental housing



Note: Incomes are defined as in Figure 2.8. Source: German Socio-Economic Panel (SOEP), author calculations.

In further analyses, we calculate the discount in housing expenditures of rental flats in the

[28]This trend speaks against Schier and Voigtländer's (2016) finding of a growing share of individuals in social and municipal housing whose income position has improved greatly since they moved in.

social or municipal sector compared to rental flats in the private sector, both raw and adjusted for housing characteristics.[29] Although the raw differential is substantial at around -20%, this difference is driven mainly by the lower quality of flats. Conditional on quality, the discount is between 5% and 8% in most years, with a slight decrease in recent years. Hence, in recent years, the social rent sector overall does not contribute much to lower housing expenditures for low-income individuals.

2.4.3 Decomposition Analysis

To quantify how strongly the various factors documented above contribute to the trends in housing expenditure shares across income groups, we now perform a decomposition analysis in which we separate the 1993–2013 change in housing expenditure shares for each income quintile into a composition effect and a coefficients effect.[30]

Table 2.3 (Panel A) reports the 1993 and 2013 shares of housing expenditures by income quintile and the aggregate decomposition of the change over time. As discussed above, the share of housing expenditures increases the most for the lowest quintile (by 11.9 pp) while decreasing slightly for the highest quintile (by 2 pp). Changes in the coefficients explain part of this divergence as they have opposite impacts at the bottom and top of the distribution, inducing a 5 pp (42% of the total 11.9 pp) increase in the housing expenditure share for the bottom quintile but a 1.5 pp (75% of the total 2 pp) reduction for the top quintile. This differential development of the coefficients effect across the income distribution mirrors our finding in Section 2.4.1 that the relative cost of renting vs. homeownership increases over the 1993–2013 period. The bottom income quintile consists mainly of renters, who are more affected by rent increases, while the top income quintile consists mainly of homeowners with outstanding mortgages who can benefit from falling mortgage interest rates.

Composition changes also explain an important part of the divergence of housing expenditure shares. For the bottom income quintile, 6.9 pp (or 58%) of the increase in expenditure shares is due to the composition effect, while for the top quintile 0.6 pp (or 25%) of the decrease is explained by composition changes. Table 2.3 (Panel B) provides a further breakdown of the composition effect into the contributions of various factors. Changes in household demographics (in particular, the rising share of single households) are a key factor for the bottom income quintile, explaining 3.3 pp (or 28%) of the increase in housing expenditure shares for this group. A second important

[29]The adjusted differential comes from a regression of log housing expenditures for renters, which additionally controls for a quadratic in dwelling size, dummies for dwelling equipment (with central heating, a garden, and a balcony), a quadratic in years of housing tenure, dummies for federal state and city size, dummies for the number of adults in a household, and dummies for the number of children in the household

[30]More specifically, we compute $\bar{y}_{13} - \bar{y}_{93} = \overline{X}_{13}\beta_{13} - \overline{X}_{93}\beta_{93} = \overline{X}_{13}(\beta_{13} - \beta_{93}) + \beta_{93}(X_{13} - X_{93})$, where $\overline{X}$ are average covariate levels and β are estimated parameters. We do not show the detailed decomposition of the coefficients effect because the relative size of individual variables is dependent on the base category for the categorical variables (see the corresponding discussion in Firpo et al. 2011).

Table 2.3: Decomposition of changes in housing expenditure shares, 1993 to 2013 (EVS)

	Quintile of equivalized net household income				
	Q1	Q2	Q3	Q4	Q5
A. Aggregate decomposition					
1993	0.266***	0.201***	0.180***	0.165***	0.155***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
2013	0.385***	0.253***	0.209***	0.176***	0.135***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Change	0.119***	0.052***	0.029***	0.011***	-0.020***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Coefficients	0.050***	0.032***	0.019***	0.005**	-0.015***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.001)
Composition	0.069***	0.020***	0.010***	0.006***	-0.006***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
B. Detailed decomposition of the composition effect					
Household Demographics	0.033***	0.010***	0.004***	0.005***	0.002***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)
Region	0.010***	0.005***	0.002***	0.001	-0.001*
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Tenure Type	0.001	-0.004***	-0.004***	-0.003***	-0.008***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
Dwelling Quality	0.006***	0.008***	0.010***	0.007***	0.004***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
Income	0.019***	0.001*	-0.002***	-0.003***	-0.003***
	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)

Note: The table shows a Blinder-Oaxaca decomposition of changes in housing expenditure shares separately for each quintile of equivalized net household income. *Household Demographics* includes dummies for the number of adults in the household, dummies for the number of children, dummies for 4 age groups (20–29, 30–39, 40–49, 50–59), and a dummy for German nationality. *Region* includes dummies for 16 federal states and 4 categories of city size. *Tenure Type* includes dummies for being a renter, owner with mortgage, or owner without mortgage. *Dwelling Quality* includes a cubic in household size and dummies for whether the dwelling is equipped with central heating or a garage. *Income* includes a cubic in eq. net household income. Standard errors are in parentheses. The counterfactual used for the decomposition is based on the composition in 2013 and the coefficients in 1993. Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Source: EVS, author calculations.

factor is change in real income, which contributes 1.9 pp (16%). As demonstrated in Section 2.3.1, real income declines at the bottom of the distribution both during the 1990s and especially in the 2000s, which leads to an increase in the share of income spent by the bottom quintile on the necessity good of housing. Change in the regional allocation of individuals (*Region*) – that is, the movement of households to more expensive regions – is a third smaller contributor to the rise in housing expenditures at the lower end of the distribution. For individuals in the top income quintile, however, the same factors either decrease housing expenditure shares (e.g., *Income* or *Region*) or have far smaller effects (*Household Demographics*).

Improvements in housing quality clearly push up housing expenditure shares for all quintiles, but these effects are strongest for the 3rd quintile (+1 pp), and weaker for both the bottom (+0.6 pp) and the top (+0.4 pp) quintile. This observation is consistent with our finding in Section 2.4.2 that the 1990's construction boom increases housing space for the middle class to a greater extent than for the bottom or top of the income distribution. Changes in quality thus do not explain why the shares of low income individuals diverge so much from those of the rest. Changes in tenure type – that is, the rising homeownership rates seen primarily in the 1990s – work to decrease housing expenditures if owners pay less than renters conditional on quality (which, as demonstrated in Section 2.4.1, is indeed the case). Hence, as Table 2.3 shows, the effect of tenure type is negative for the higher quintiles who see an increase in homeownership rates over time (see Section 2.4.1) but positive for the bottom quintile whose homeownership rate decreases.

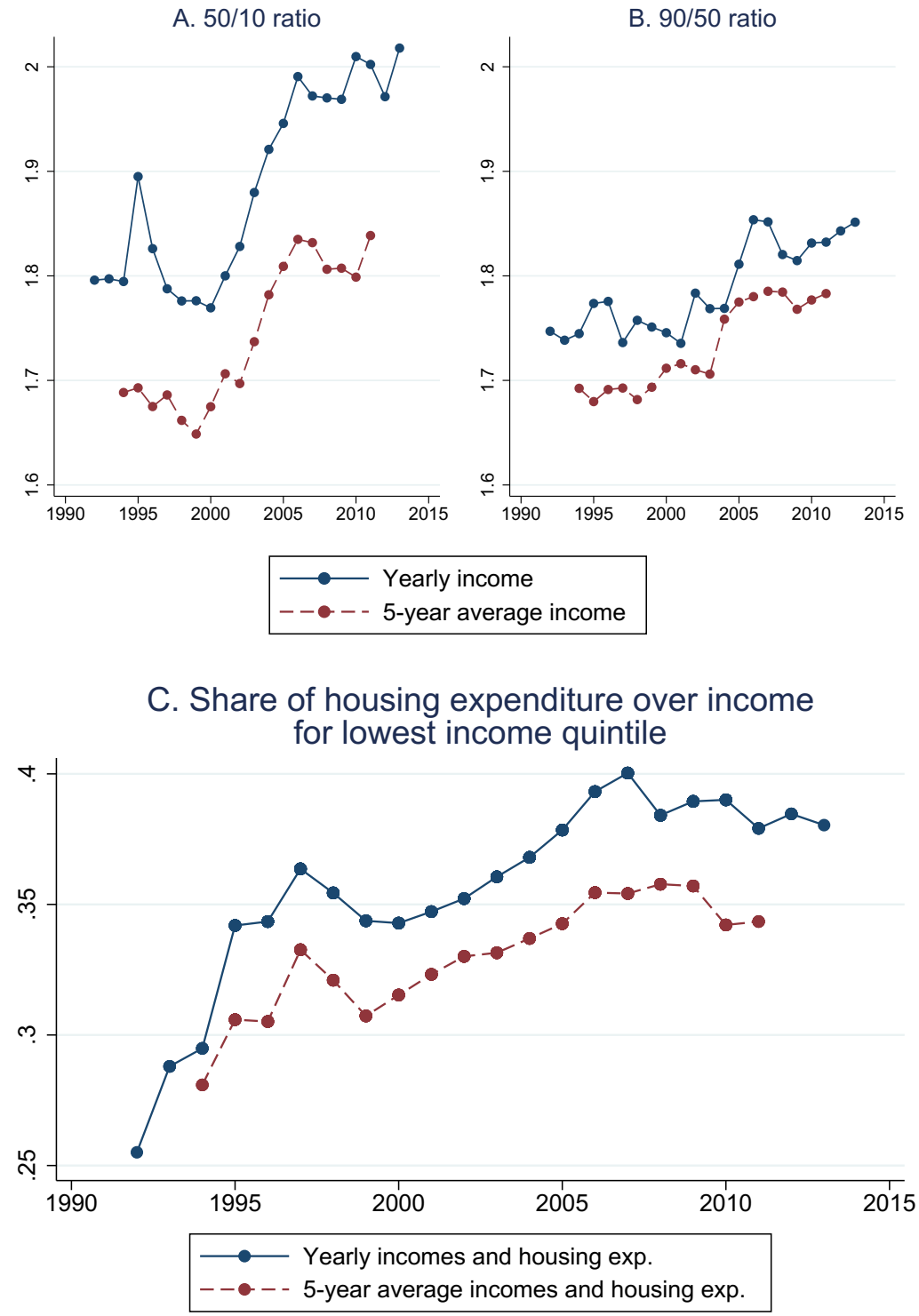
The findings for the EVS are confirmed in Appendix Table 2.D1 by the results of the analogous decomposition using the SOEP data, highlighting again the strong roles of the coefficient effect, household demographics, and income. The SOEP data allow us to additionally consider the role of changes in social housing and residential mobility. We find that neither contributes much to the increase in the share of income spent on housing by those in the bottom quintile.

2.5 Lifecycle Inequality and Intergenerational Trends

2.5.1 Permanent versus Transitory Inequality

Because part of cross-sectional income inequality in a given year may reflect transitory income shocks, it may overstate inequality over the lifecycle (Gottschalk and Moffit 1994). For example, if individuals in the bottom quintile in a given year were to move more quickly to a higher quintile in the next year, this rising income mobility could compensate the trend toward rising inequality. Moreover, households at the bottom might respond to higher housing expenditures by moving to cheaper accommodations. To address these possibilities, we use the panel dimension of the SOEP, calculate the within-person average of household income and housing expenditure over a five-year

Figure 2.19: Yearly income vs. income averaged over five years



Note: For year t, the five-year average of income and housing expenditure is calculated as a moving average: $\frac{1}{5}(y_{t-2}+y_{t-1}+y_t+y_{t+1}+y_{t+2})$. Incomes and housing expenditures are defined as in Figure 2.8. Source: German Socio-Economic Panel (SOEP), author calculations.

moving window, and compare these "long-term" measures to the respective yearly measures.[31]

Panels A-B in Figure 2.19 show evidence for income smoothing, as the levels of the 50/10 and 90/50 ratios are lower for five-year-average incomes than for yearly incomes. However, the increase in inequality, especially at the bottom, is also visible for the five-year-average. Likewise, the share of long-term housing expenditure over long-term income for the bottom quintile (Figure 2.19, Panel C) is about 3 pp lower in levels than when yearly measures are considered, although the strong upward trend is similar. Overall, therefore, changes in year-to-year income mobility do not offset the rising inequality of yearly incomes.[32] The results also suggest that households do not proportionately reduce housing expenditures when incomes fall. A possible reason is that rents for new contracts are often higher than rents for existing contracts, so that reducing housing expenditures would mean substantially reducing housing quality (see Section 2.4.2).

2.5.2 Cohort Effects and Intergenerational Trends

Two other important questions implied by the research are how these inequality trends affect subsequent cohorts and what implications they have for intergenerational inequality. Table 2.4a, which reports the 50/10 and 90/50 ratios of income within different birth cohorts and age groups, illustrates a typical age profile of inequality. That is, the 50/10 ratio is high among individuals aged 20–29 (when some are still in education and have low income, while others are already working) and then decreases in the 30–39 age range before increasing again up until the 50–59 range (reflecting the steeper earnings growth of individuals with high income). Successive cohorts, however, begin with higher inequality at any given age, with a 50/10 ratio of 1.63 for 30–39 year olds in the 1954–63 cohort, 1.70 for those in the 1964–73 cohort, and 1.83 for those in the 1974–83 cohort. The increase in the 90/50 ratio is similar across cohorts, albeit more muted.

Also, the share of income spent on housing has changed across cohorts, both overall and for the bottom and the top income quintile (Table 2.4b, Panels A-C).[33] When pooling all income groups, we find a moderate increase in the share of income spent on housing across cohorts by age. For instance, the average share of income spent on housing by those aged 20–29 increases from 19.4% for the 1964–73 cohort to 24.2% for the 1984–93 cohort (Table 2.4b, Panel A). Moreover, there are strong differences across income quintiles, with the share of income spent on housing increasing strongly across cohorts for all age groups in the bottom income quintile (e.g., by 11.4 pp and 14 pp for those aged 20–29 and 50–59, respectively) but remaining constant or even falling for those

[31] The five-year average income in year t is calculated as $\frac{1}{5}(y_{t-2}+y_{t-1}+y_t+y_{t+1}+y_{t+2})$. If an individual is not observable for the full five-year period, we only average over the years in which that person is observed. About 4% of individuals are not observable for at least three years and so are dropped.

[32] Our results confirm previous analyses that show falling wage and income mobility in Germany since the 1990s (Riphahn and Schnitzlein 2016, Grabka and Goebel 2013). Bönke et al. (2015) also document higher *lifetime* earnings inequality for German cohorts born in the 1960s than for previous cohorts.

[33] The quintiles are defined within each cohort-age group cell.

Table 2.4a: Cohort changes in income inequality

	Birth cohort					
	1934-43	1944-53	1954-63	1964-73	1974-83	1984-93
A. 50/10 ratio of eq. net hh. income						
Age 20-29				1.828	1.898	1.912
Age 30-39			1.629	1.698	1.832	
Age 40-49		1.787	1.804	1.885		
Age 50-59	1.815	2.048	2.152			
B. 90/50 ratio of eq. net hh. income						
Age 20-29				1.701	1.753	1.780
Age 30-39			1.820	1.836	1.888	
Age 40-49		1.865	1.897	1.943		
Age 50-59	1.895	1.966	2.015			

Note: Incomes and housing expenditures are defined as in Figure 2.8. Source: EVS, author calculations.

in the top income quintile (e.g., no change for the 20–29 age range and a decline of 2 pp for those aged 50–59). Finally, homeownership rates change both within and across cohorts (Panels D-F).[34] For a given cohort, the share of homeowners increases with age. Within age groups, this share increases until the 1964-73 cohort, but then declines for younger cohorts. To illustrate, the share of homeowners at age 30–39 is 36.7% for the 1954–63 cohorts, increases to 44.4% for the 1964–73 cohorts, and then declines to 40.8% for the 1974–83 cohorts (Panel D). The drop in homeownership rates for younger cohorts seems to affect both the bottom and top income quintiles (Panels E-F), and may reflect changing patterns of household and family formation.

Taken together, we find that more recent cohorts show higher income inequality at any age. Moreover, low-income individuals in more recent cohorts spent considerably more on housing than low-income individuals of previous generations, and experience falling homeownership rates. This implies that low-income individuals among the young in particular will have lower savings and wealth to accumulate over their lifetime.

2.6 Discussion and Conclusions

By analyzing the trends in inequality of household income and housing expenditures – the largest component of household consumption – over the last two decades in Germany, we demonstrate that inequality in income after housing expenditures increases more than that before housing expenditures, with the 50/10 ratio increasing threefold once housing expenditures are considered. For the bottom income quintile, the share of income spent on housing rises considerably, while for other income quintiles it increases much less or even slightly declines.

[34] Individuals who live with homeowning parents are not counted as homeowners, an exclusion that is mainly relevant for the 20-29 age group.

Table 2.4b: Cohort changes in homeownership and housing expenditure shares

	Birth cohort					
	1934-43	1944-53	1954-63	1964-73	1974-83	1984-93
A. Share of income spent on housing: All						
Age 20-29				0.194	0.229	0.242
Age 30-39			0.212	0.231	0.231	
Age 40-49		0.190	0.218	0.221		
Age 50-59	0.189	0.221	0.233			
B. Share of income spent on housing: Lowest income quintile						
Age 20-29				0.274	0.355	0.388
Age 30-39			0.269	0.326	0.350	
Age 40-49		0.257	0.328	0.361		
Age 50-59	0.277	0.360	0.417			
C. Share of income spent on housing: Top income quintile						
Age 20-29				0.143	0.148	0.143
Age 30-39			0.180	0.167	0.149	
Age 40-49		0.161	0.156	0.138		
Age 50-59	0.144	0.146	0.124			
D. Share of homeowners						
Age 20-29				0.132	0.140	0.113
Age 30-39			0.367	0.444	0.408	
Age 40-49		0.549	0.577	0.587		
Age 50-59	0.563	0.600	0.608			
E. Share of homeowners: Lowest income quintile						
Age 20-29				0.061	0.049	0.038
Age 30-39			0.258	0.279	0.237	
Age 40-49		0.399	0.365	0.358		
Age 50-59	0.422	0.371	0.335			
F. Share of homeowners: Top income quintile						
Age 20-29				0.252	0.290	0.197
Age 30-39			0.471	0.542	0.490	
Age 40-49		0.721	0.731	0.722		
Age 50-59	0.744	0.788	0.803			

Note: Incomes and housing expenditures are defined as in Figure 2.8. Source: EVS, author calculations.

These trends can be attributed to several factors. First, an increase in rental prices during the 1990s makes renting more expensive, while for owner-occupiers, housing expenditures rise far less and even fall after the mid-2000s because of falling mortgage interest rates and lower outstanding mortgages. Altogether, this has distributional consequences given that owners are more likely to be from the upper part of the income distribution. In calculating net imputed rents for homeowners, we find a sharp decrease in the relative costs of homeownership versus renting. Additional factors that contribute to rising housing expenditures at the lower end of the income

distribution include compositional changes, mainly in household structure (a rising share of single households) and regional migration patterns (a rising share of those living in large cities and in West Germany). The decline in the provision of social housing plays only a minor role. Finally, the share of income spent on housing as a necessity good is further increased by declining real income among individuals at the lower end of the income distribution.

Many of the above findings mirror those for Anglo-Saxon countries. For example, rising housing expenditure shares, especially for renters and low-income individuals, are documented for both the U.S. (Quigley and Raphael 2004, Albouy et al. 2016, Larrimore and Schuetz 2017) and the UK (Belfield et al. 2015). However, the *magnitude* of both levels and changes is more moderate in Germany.[35] At the same time, in contrast to the UK, where per capita household living space falls (Belfield et al. 2015), housing quality for low-income individuals in Germany improves over time. In fact, homeownership rates in Germany slightly decrease for the most recent cohorts, although the changes across generations are far smaller than in the U.S. or UK (Goodman and Mayer 2018, Belfield et al. 2015).[36] Interestingly, in contrast to Moretti's (2013) reported findings for the U.S., trends in regional mobility toward more expensive areas do not mitigate trends in inequality in Germany.

Although the recent developments in housing expenditures in Germany are relatively modest when considered in an international context, the strong rise in inequality of after-housing disposable income is nonetheless important. For the bottom income quintile, the sizeable increase in the share of income spent on housing is associated with an overall decrease in savings, which fall from 2% to -1%, and with a decrease in the share with positive savings from 64% to 53%. For all other income quintiles, savings rates are higher and decrease by less.

This development is worrying not only because of its immediate impact on savings but for its long-term effect on wealth accumulation at a time of significantly reduced public pension benefits and government efforts to stimulate private savings as complementary retirement funding, moving the German model closer to that of Anglo-Saxon countries. In this context, our findings that a large and growing share of low-income individuals do not save is especially concerning,[37] especially given that lower access to mortgages in Germany (relative to the U.S. and UK) reduces the possibility of wealth accumulation through housing property, particularly for the less well-off.

[35] For example, 2014 data from the OECD Affordable Housing Database show that for renters in the bottom income quintile, the median share of income spent on rents (excluding heating costs and utilities) was 27% in Germany, 42% in the UK, and 50% in the U.S. The OECD data, however, concern the household level and exclude heating costs and utilities, so the expenditure shares for Germany are lower than the shares reported in our paper (see `http://oe.cd/ahd` for further information). Using the OECD definition for the EVS data used in our paper, we obtain an income share spent on rents of 28% in the lowest income quintile, which is quite similar to the number reported by the OECD.

[36] Belfield et al. (2015) report that homeownership at age 25 in the UK more than halves between cohorts born in the mid-1960s (45%) and those born in the mid-1980s (20%). For the U.S., Goodman and Mayer (2018) report a sharp decline in homeownership among young individuals aged 25–34, from 49% in 2005 to 35% in 2015.

[37] See also Corneo et al. (2009) who conclude that attempts to boost the savings rate of low-income households via government subsidies have so far not been successful.

Rising inequality in savings is thus even more likely to contribute to higher wealth inequality in the future.[38]

[38]For the US, Kuhn et al. (2017) show that housing wealth is the most important component of the wealth portfolio for the middle class, and that changes in the housing market are key drivers for wealth inequality. Saez and Zucman (2016) show that rising inequality of savings rates in the US over the last decades are a driver for rising wealth inequality.

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Appendix to Chapter 2

Appendix 2A: Data Appendix

Threshold for Top Incomes. Representativeness of the EVS at the very top end of the distribution is limited by the fact that households above a certain income threshold are not included in the data, since participation rates of this group are very low. This threshold amounted to a monthly net household income of 35,000 Deutschmark (17.895 €) in the 1993 and 1998 waves, and 18,000 €in the 2003, 2008 and 2013 waves. Becker (2014) finds that this restriction affects less than 1% of all German households in each year. Excluding these households certainly leads to underestimation of inequality in the upper part of the distribution. However, percentile ratios (such as the ratio of the 90th to the 50th percentile of the income distribution) should be less sensitive to outliers in the tails than, for example, measures like the variance or top income shares. Moreover, most of our attention is focused on the lower part of the distribution.

Self-employment and Capital Income. A well-known problem of household surveys is that they tend to underestimate income from self-employment or capital income. For example, Becker (2014), by comparing EVS and SOEP data to aggregate data from German national accounts, shows that although both household surveys capture income from dependent employment and public transfers very well, they capture only half the income from self-employment or capital income that is shown in national accounts. This, again, should contribute to underestimation of inequality in particular at the top of the distribution.

Age Ranges. We also compare the key analyses for the whole sample without age restriction, for the age range 20–60 and the age range 25–55. As shown in Figure 2.A1, the trends are similar, although the patterns are most pronounced for the 20–60 age range.

Survey Weights. From the 2003 wave onwards, the surveys use both household weights and person weights. Household weights adjust for the characteristics household type, social status of the main earner, and net household income; person weights additionally adjust for individual income, gender, age and social status (see Statistisches Bundesamt 2005a, 2005b, 2012, and 2016 for a further description). Because our analysis is on the individual level, we use the person weights, which we impute for the 1993 and 1998 waves by taking the individuals in the 2003 wave and regressing the log ratio of household and person weight on household characteristics (federal state, household size, decile of net household income) and individual characteristics (position in household, gender, age, nationality, labor force status, and decile of individual labor income). We then predict the person weight for each individual in the 1993 and 1998 wave based on his or her household weight.

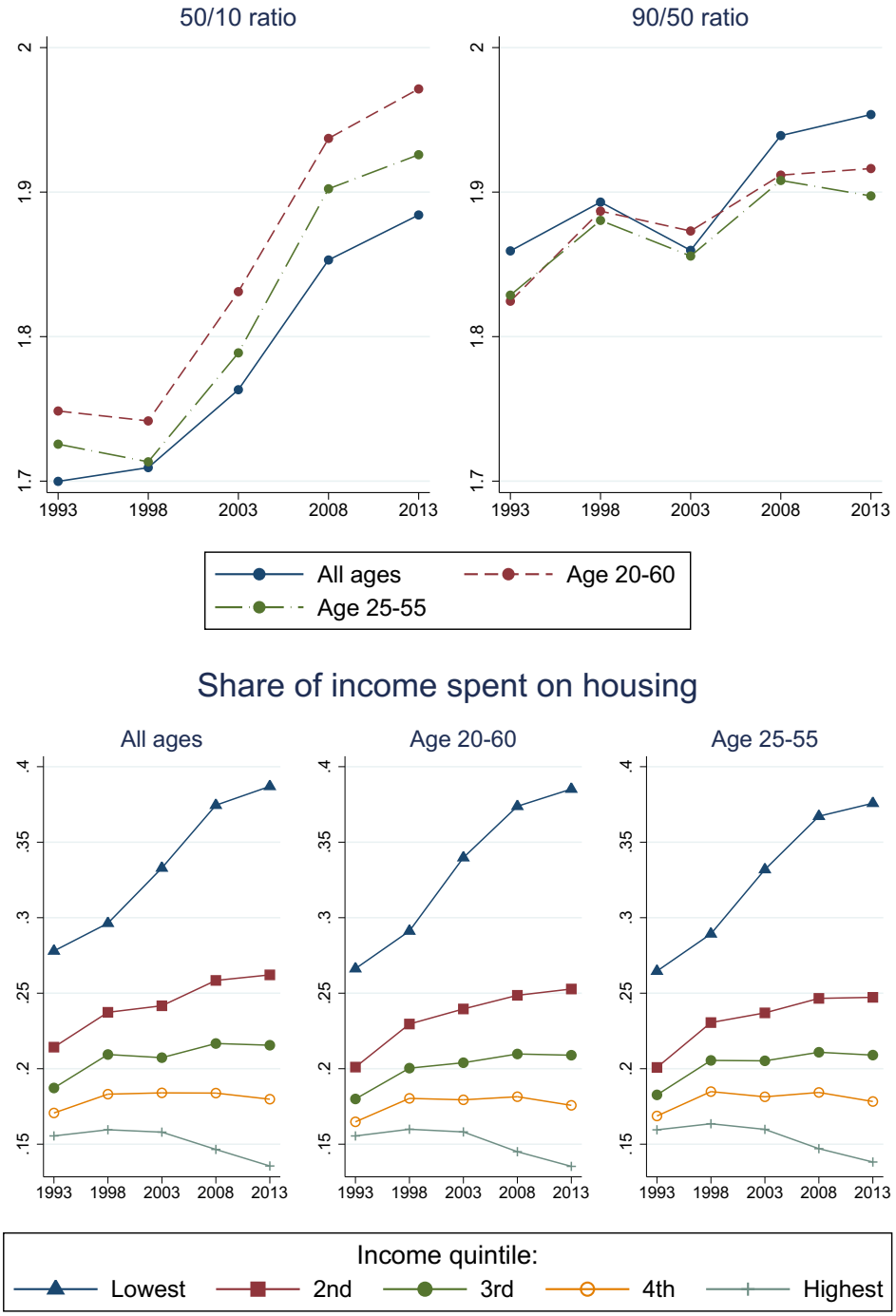
Mortgage Interest Payments. In the 1998 wave, there is a low share of mortgage interest payments relative to total mortgage payments (interest payments plus repayment of mortgage capital) of 34%, while it is higher in the other surveys (47% in 1993, 54% in 2003, 50% in 2008, and

45% in 2013). To smooth the series, we take the 1993 and 2003 samples and regress the ratio of mortgage interest relative to repayment of mortgage capital on dwelling and household characteristics. We then take the 1998 sample and predict the ratio for each observation based on the characteristics and the average of the estimated coefficients from 1993 and 2003. Based on this predicted ratio, we impute mortgage interest payments for 1998.

EVS vs. SOEP Data. We employ the 1992 to 2013 waves of the yearly SOEP household panel, using sample selection criteria and variable definitions that are comparable to the EVS and restricting the sample to individuals aged 20–60. Household incomes and expenditures are measured on the household level, equivalized by the number of persons in the household, and then distributed among all household members. In the SOEP, net household income also includes the sum of labor income from dependent employment and self-employment, capital income, private transfers, and public transfers minus taxes. It excludes imputed rent from owner-occupied housing. Housing expenditures include rent and energy costs for renters, as well as mortgage interest, energy costs, and maintenance costs for owner-occupiers. In the SOEP, mortgage payments include both interest payments and repayment of mortgage capital. We exclude the latter as it is not part of housing consumption but increases net wealth. From each wave of the EVS, we calculate the share of mortgage interest relative to total mortgage payments (separately for owners in each income quintile) and apply this correction factor to the mortgage payments in the SOEP, interpolating between years in which the EVS was not conducted.

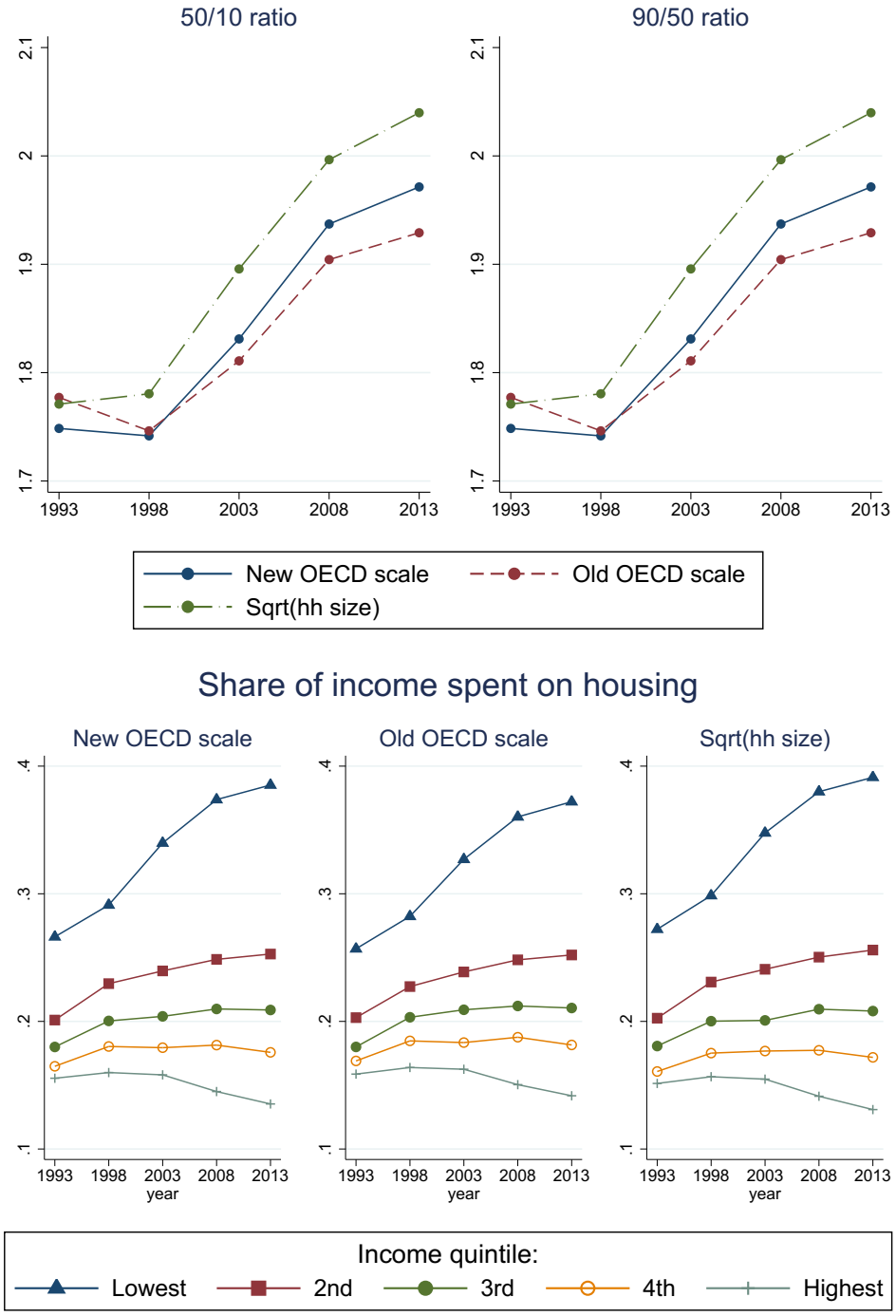
Figure 2.A3 shows the 50/10 and 90/50 ratios of equivalized net household income in both data sets. The SOEP numbers fluctuate considerably between some years, probably due to the low sample size. Nevertheless, the SOEP and EVS show very similar trends. The 50/10 ratio increases between the late 1990s and the mid-2000s, followed by a more modest increase in recent years. The 90/50 ratio shows a similar upward trend in both data sets, but the levels of upper-end inequality are higher in the EVS than in the SOEP. This is because the levels of net household income are higher in the EVS, particularly at the 90th percentile (not shown here). These differences at the top of the net income distribution between the two data sets might be driven by the different ways taxes are measured: tax payments are self-reported by households in the EVS, while the SOEP simulates taxes based on income and official legal rules. Becker et al. (2003) and Becker (2014) argue that this simulation does not consider potential loopholes or special tax exemptions, which might lead to an overestimation of taxes for richer households. This argument is supported by our finding in Figure 2.A4 that the levels of the 90/50 ratio are very similar in the SOEP and EVS. Figure 2.A5 shows that both data sets agree on the increasing divergence in housing expenditures between income groups, in particular the strong increase for the bottom income quintile.

Figure 2.A1: Alternative age ranges



Note: Further definitions of incomes and housing expenditures see Figure 2.8. Source: EVS, author calculations.

Figure 2.A2: Alternative equivalence scales

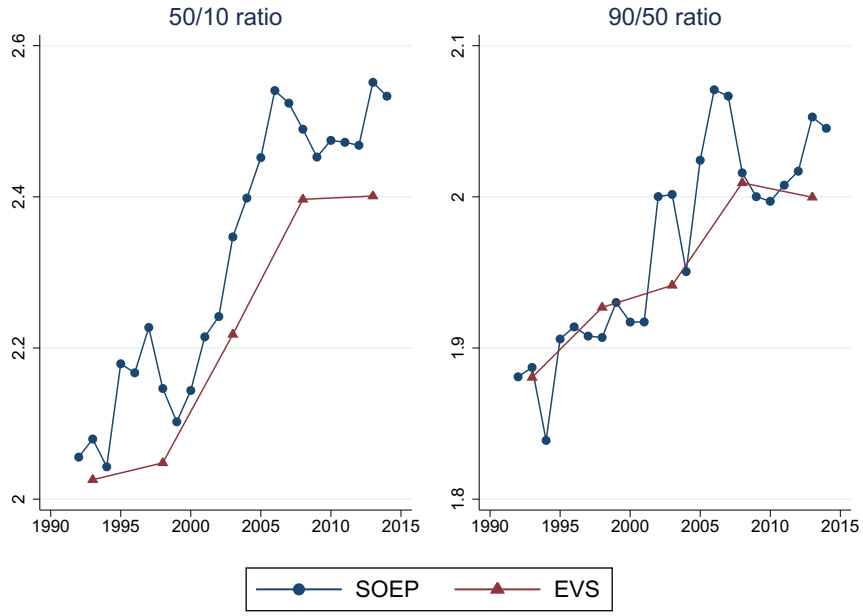


Note: The "new OECD scale" is the default used in the paper, and assigns a weight of 1 for the first adult in the household, 0.5 for every household member of age 14 and above, and 0.3 for every household member below 14. The "old OECD scale" uses weights 1, 0.7 and 0.5, respectively. "Sqrt.(hh size)" divides household income by the square root of household size. Note: EVS, author calculations.

Figure 2.A3: Inequality of equivalized net household income: EVS vs. SOEP

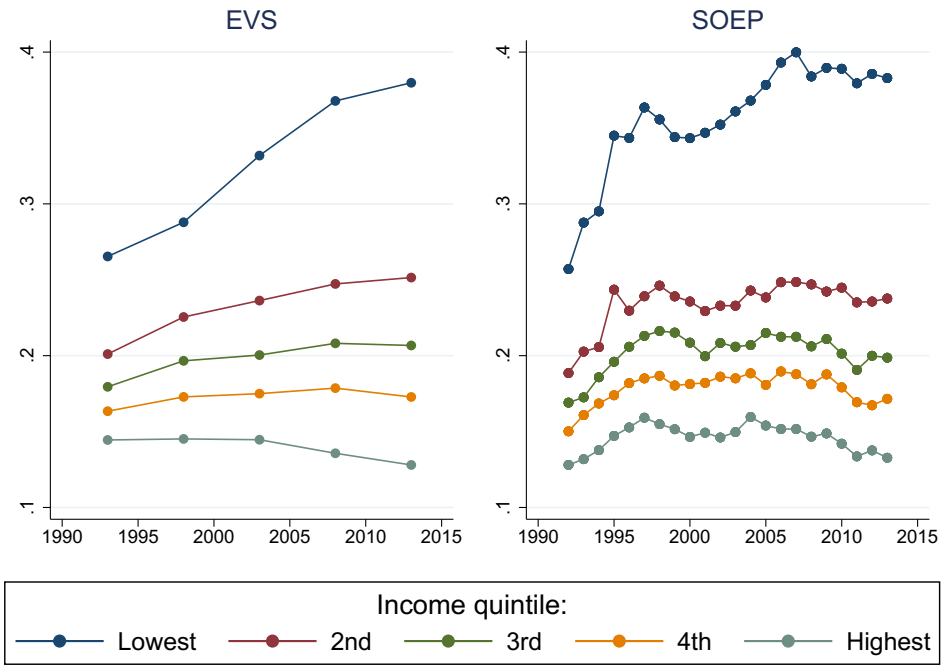
Note: Further definitions of incomes and housing expenditures see Figure 2.8. Source: SOEP and EVS, author calculations.

Figure 2.A4: Inequality of equivalized gross household income: EVS vs. SOEP



Note: Further definitions of incomes and housing expenditures see Figure 2.8. Source: SOEP and EVS, author calculations.

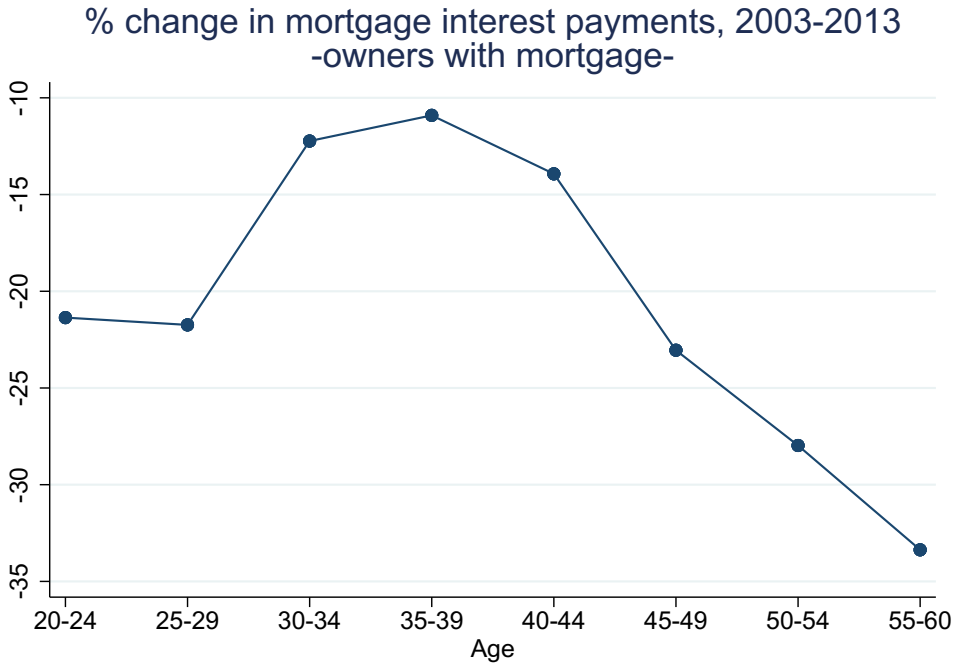
Figure 2.A5: Share of housing expenditures over income: EVS vs. SOEP



Note: Further definitions of incomes and housing expenditures see Figure 2.8. Source: SOEP and EVS, author calculations.

Appendix 2B: Additional Material for Section 2.4.1 (Relative Costs for Homeowners vs. Renters)

Figure 2.B1: Percent change in mortgage interest payments, 2003–13, for owners with mortgages

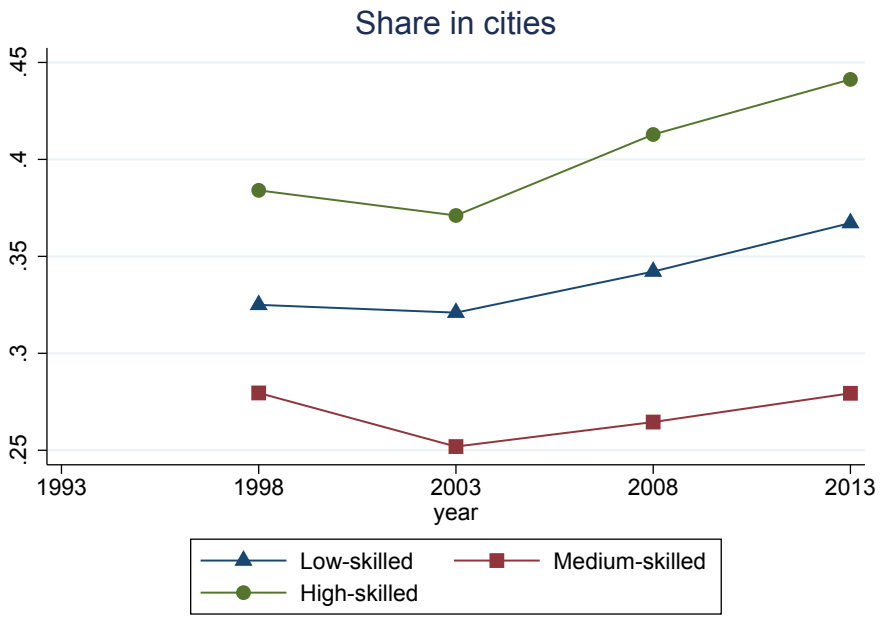


Source: EVS, author calculations.

Method for Imputing Net Imputed Rents (NIR) among Homeowners. Building on Machado and Mata (2005) and Melly (2005), we apply the following procedure. First, we take the sample of renters and estimate a series of quantile regressions of housing expenditures on dwelling and household characteristics at 99 equispaced quantiles from $\theta = 0.01, \ldots, 0.99$. We then take the sample of owner-occupiers and predict for each observation the 99 conditional quantiles of the counterfactual housing expenditures. Finally, we inflate the data set by 99; that is, we use each predicted quantile as an owner observation with weight 1/99. For each observation in the inflated data set, we subtract the actual housing expenditures to obtain the net imputed rent (NIR). The relative NIR is obtained by dividing the absolute NIR by the owner household's counterfactual housing expenditures, which we calculate separately for owner occupiers with and without mortgage debt.

Appendix 2C: Additional Material for Section 2.4.2 (Regional Mobility and the Effect of Regional CPIs)

Figure 2.C1: Share living in cities, by skill group



Note: Information on education is not available in the 1993 wave. Low-skilled = no postsecondary degree, medium-skilled = vocational training degree or higher secondary school degree, and high-skilled = tertiary education degree. Students are excluded. Source: EVS, author calculations.

Table 2.C1: Reasons for residential moves by skill group, in percentages

	Low-skilled		Medium-skilled		High-skilled	
	Rural-to-city moves	Other moves	Rural-to-city moves	Other moves	Rural-to-city moves	Other moves
Job reasons	32.9	6.0	30.5	8.9	51.8	20.8
Family reasons	32.2	35.3	46.2	37.5	28.2	29.8
Old dwelling too small/too big	26.2	38.3	12.7	29.9	11.5	25.4
Bought own home	1.0	8.6	2.9	14.4	2.8	17.3
Other reasons	7.6	11.8	7.8	9.3	5.7	6.7

Note: The numbers in the table are based on the survey question: "What was the main reason for your last residential move?" Skill groups are defined as in Figure 2.C1. Source: SOEP, author calculations.

Regional CPI Data. A regional CPI for Germany is available only for 2009 (see BBSR 2009 for a detailed data description). The regional CPI data and regional rent data are limited to the district (Kreis) level, while the EVS data contain more aggregate regional information based on federal states and three classes of community sizes. To merge both data sets, we thus had to aggregate the district-level price data accordingly.

Based on these data, we construct two types of regional price indices over time. First, we simply impute the 2009 level for all years, ignoring region-specific price changes and considering only the effect of mobility between more or less expensive regions. Second, we use the region-specific information on new rental contracts that is available from 2004 onward (see BBSR) to extrapolate the cross-sectional index (for 2003, we simply impute the 2004 value of the rent index). We then deflate incomes by either one of these indices.

Table 2.C2: Inequality of equalized net household income (EVS)

	50/10 ratio			90/50 ratio		
	1993	2003	2013	1993	2003	2013
Nationwide CPI	1.75	1.83	1.97	1.82	1.87	1.92
Regional CPI	1.74	1.83	1.97	1.80	1.86	1.90
Regional CPI + regional rent index	-	1.83	1.98	-	1.86	1.91

Note: Incomes are defined as in Figure 2.8. Source: EVS, author calculations.

Table 2.C3: Inequality of daily wages (SIAB)

	50/20 ratio			90/50 ratio		
	1993	2003	2010	1993	2003	2010
Nationwide CPI	1.42	1.47	1.57	1.37	1.40	1.47
Regional CPI	1.39	1.45	1.54	1.33	1.38	1.45
Regional CPI + regional rent index	-	1.44	1.53 -	1.38	1.45	

Note: Data are for social security-covered full-time workers age 20-60. Source: SIAB7510, author calculations.

Table 2.C4: Skill premia (SIAB)

	Medium-skilled vs. Low-skilled			High-skilled vs. Medium-skilled		
	1993	2003	2010	1993	2003	2010
Nationwide CPI	0.16	0.18	0.20	0.48	0.55	0.60
Regional CPI	0.15	0.17	0.20	0.45	0.52	0.57
Regional CPI + regional rent index	-	0.17	0.19	-	0.52	0.57

Note: Premia are based on a regression of log daily wages for social security-covered full-time workers aged 20-60, controlling for education (low/medium/high), exp,exp^2, age, age^2, gender and a German nationality dummy. *Low-skilled* = no postsec. degree, *Medium-skilled* = vocational training degree or higher secondary school degree, and *High-skilled* = tertiary degree. Source: SIAB 7510, author calculations.

Appendix 2D: Additional Material for Section 2.4.3 (Decomposition Analysis)

Table 2.D1: Decomposition of changes in housing expenditure shares, 1992/93 to 2012/13 (SOEP)

	Quintile of equivalized net household income				
	Q1	Q2	Q3	Q4	Q5
A. Aggregate decomposition					
1992/93	0.286***	0.206***	0.183***	0.171***	0.145***
	(0.003)	(0.003)	(0.005)	(0.003)	(0.002)
2012/13	0.392***	0.239***	0.201***	0.173***	0.140***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.001)
Change	0.106***	0.033***	0.018***	0.002	-0.005**
	(0.004)	(0.003)	(0.006)	(0.004)	(0.002)
Coefficients	0.033***	-0.003	-0.001	-0.021***	-0.008***
	(0.006)	(0.005)	(0.006)	(0.008)	(0.003)
Composition	0.072***	0.036***	0.019***	0.024***	0.002
	(0.004)	(0.003)	(0.003)	(0.006)	(0.002)
B. Detailed decomposition of the composition effect					
Household Demographics	0.026***	0.016***	0.011***	0.006***	0.005***
	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)
Region	0.002	-0.001	-0.001	-0.002**	0.001**
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Tenure Type	0.003**	-0.001	0.001*	0.002***	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Dwelling Quality	0.006***	0.013***	0.011***	0.011***	0.006***
	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)
Social/Municipal Housing	0.003***	0.002***	0.001	0.001**	-0.000
	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)
Length of Residency	0.002**	0.001***	0.001**	-0.000	0.002***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)
Income	0.030***	0.006**	-0.005***	0.005	-0.009***
	(0.002)	(0.003)	(0.002)	(0.006)	(0.001)

Note: The table shows a Blinder-Oaxaca decomposition of changes in housing expenditure shares separately for each quintile of equivalized net household income. *Household Demographics* includes dummies for the number of adults in the household, dummies for the number of children, dummies for 4 age groups (20–29, 30–39, 40–49, 50–59), and a dummy for German nationality. *Region* includes dummies for 16 federal states and 4 categories of city size. *Tenure Type* includes dummies for being a renter, owner with mortgage, or owner without mortgage. *Dwelling Quality* includes a cubic in household size, dummies for 5 building types, and dummies for whether the dwelling is equipped with central heating, balcony, basement, or garden. *Length of Residency* includes dummies for 4 categories of residency length (<5 years, 5-9 years, 10–19 years, and 20+ years). Income includes a cubic in eq. net household income. Standard errors are in parentheses. The counterfactual used for the decomposition is based on the composition in 2012/2013 and the coefficients in 1992/1993. Source: SOEP, author calculations.

Chapter 3

Explaining Gaps in Educational Transitions Between Migrant and Native School Leavers

3.1 Introduction

Compared to their native peers, school leavers with a migration background in many countries are considerably less likely to take up qualified training after school and more likely to be non-employed or to enter lower quality training. These differences in post-schooling trajectories have important implications for migrants' future integration into the labour market and society. A large literature has investigated possible reasons for these gaps.[1] Most of these studies have focused on migrants' worse parental background or skill endowments before leaving school as possible explanations.

Another key aspect, however, is how young native and migrant pupils differ in their career planning, and which implications this has for their post-schooling trajectories. The highly stratified nature of many education systems requires school leavers to possess sufficient information on which occupations or educational options exist after school and which skills and efforts are necessary to reach a certain path. However, previous research has emphasized that some pupils may not always be able to formulate realistic career plans which are in line with their capabilities (Koch et al. 2015; Lavecchia et al. 2016). For example, pupils from low-SES background were found to have lower educational aspirations than pupils from high-SES backgrounds who have similar ability (Guyon and Huillery 2016; Hoxby and Avery 2013). On the other hand, there is the concern that some low-performing students have unrealistically high aspirations for academic

[1] This includes, among others, Hunkler (2014) or Diehl et al. (2009) for Germany; Latina and Ramirez (2013) or Wolter and Zumbuehl (2017) for Switzerland; Belzil and Poinas (2010) for France; Colding et al. (2009) for Denmark; or Baert and Cockx (2013) for Belgium.

education and may not be sufficiently informed about other alternatives such as vocational training (Goux et al. 2015).

This paper studies the context of Germany, which has a tracked secondary school system that restricts access to tertiary education to those school leavers from the higher secondary track. Vocational training is an alternative route which provides qualified training for those school leavers who do not enter tertiary education. I ask which factors explain the differences in transitions after secondary school between pupils of native German background and German-born pupils with a migration background.[2] The analysis focuses on the transition in the first year after having left secondary school and distinguishes between three possible states: no qualified training, vocational training, and tertiary education. The data come from the Starting Cohort 4 of the National Educational Panel Study (NEPS), a panel survey on pupils who were sampled in the 9th grade of secondary school and followed over subsequent years. The survey offers exceptionally rich information on school leavers, including pupils' school grades and degrees, their test scores in reading and mathematics, or their leisure activities. Moreover, the data also allow to use school fixed effects to account for the sorting of migrant and native pupils to specific types of schools which also potentially affect transitions after school. Finally, career aspirations and expectations of both the pupils and their parents are surveyed in great detail.

The results can be summarized as follows. Parental background, skills and school fixed effects go some way towards explaining the migrant-native gaps, in particular the higher risk of migrants of not taking up without qualified post-school training. However, these factors can't account for all differences. Conditional on these variables, there is a striking "polarization" in educational choices: migrants are more likely to attend tertiary education, more likely to end without qualified training, and less likely to attend vocational education than their background and skills would predict. This pattern is present among both genders, but is considerably stronger among boys.

I argue that a key explanation for this polarization is that migrant pupils and their parents have on average more academically oriented career expectations and aspirations before leaving school than natives of similar parental background and skills. Correspondingly, migrants are less likely to apply for vocational training and if they do so, they tend to choose more competitive training occupations. These differences are present along the whole skill distribution, but they have very different effects for low- and high-skilled pupils. On the one hand, their higher aspirations allow high-skilled migrants to achieve tertiary education despite their less favourable background. On the other hand, less skilled migrants who do not have the option to attend tertiary education, are diverted from vocational training as a more viable alternative. I show that additionally controlling for these career aspirations and expectations can explain a large part of the remaining gaps.

Finally, I explore various possible explanations for the migrants' higher aspirations and ex-

[2]In the remainder of the paper, all pupils who only have German as their mother tongue will be referred to as "natives", while pupils with a mother tongue other than German will be referred to as "migrants". Technically speaking, the latter are second- or third-generation migrants.

pectations, including expected labour market returns to education, expected discrimination, the intention to leave Germany, overconfidence, or access to information. Compared to natives, migrants expect higher returns to tertiary compared to vocational occupations, and they also are more likely to intend to leave Germany in the future. Nevertheless, both factors only explain a small part of the migrants' more ambitious career plans. Moreover, expected discrimination in the apprenticeship market has no effect on migrants' career plans. I also find no evidence that migrants generally overestimate their skills. I conclude that information deficits and the migrants' lower familiarity with the German education system likely play a key role for why migrants have both higher aspirations and expectations.

The present study is descriptive in nature and does not use e.g. experimental variation in aspirations or expectations. I can't rule out that career plans are driven by further unobserved characteristics, but the very detailed set of controls should mitigate many concerns about endogeneity. One issue with the use of aspirations and expectations in explaining educational outcomes is potential reverse causality, i.e. that individuals adapt their stated career plans depending on their educational performance (also called "ex-post rationalization", see e.g. Zafar 2011 and the literature cited therein for a detailed discussion). This issue, however, is also mitigated in the present context due to the fact that in the NEPS data, pupils' aspirations and expectations are measured before leaving school and are thus not influenced by the post-school transition.[3] But more importantly, a simple story of reverse causality is also inconsistent with the fact that the migrants are more likely to expect to work in a tertiary occupation, but are more likely to end up without any qualified training.

The paper contributes to various strands of the literature. First, several papers have studied post-schooling transitions of migrant and native youth, such as Hunkler (2014) or Diehl et al. (2009) for Germany; Latina and Ramirez (2013) or Wolter and Zumbuehl (2017) for Switzerland; Belzil and Poinas (2010) for France; Colding et al. (2009) for Denmark; or Baert and Cockx (2013) for Belgium. However, based on data limitations, these studies have only been able to control for a rather coarse set of characteristics. The present data allow me to control for a much richer set of variables, in particular detailed measures of cognitive skills (test scores in reading and mathematics), leisure activities, school fixed effects, as well as career plans.

An issue specific to Germany and a few other countries is the prominent role of the vocational training system, which mostly takes place in the form of firm-based apprenticeship training (see Wolter and Ryan 2011 for a detailed review). Vocational training provides qualified training also for those school leavers who do not complete the higher secondary degree and are thus not eligible to attend tertiary education. It has been documented that migrants are less represented in the vocational training system (Diehl, Friedrich, and Hall 2009, Hunkler 2014). Since the apprenticeship

[3]For example, Fortin et al. (2015) study a setting in which pupils' expectations about the future (namely, boys' and girls' expectations about labour market outcomes) are measured at the same time as the outcome variable (boys' and girls' performance in school), and acknowledge the possible problem of reverse causality. The same holds for Attanasio and Kaufmann (2014, 2017) who study pupils' expected returns to education.

market in principle works like a regular job market (that is, school leavers apply for training places at firms and firms decide on which applicant to hire for an open position), discrimination by firms against school leavers with a migration background is potentially an issue.[4] My paper does not rule out discrimination in vocational training as a further explanatory factor, as there remains an unexplained gap even after controlling for background, skills, and career plans. Still, these variables account for the bulk of the migrant-native differences, suggesting that these factors should be a prime focus for policy interventions.[5,6]

There is also a literature on migrants' performance within the school system, considering outcomes such as school degrees or cognitive test scores. This includes, among others, Ammermüller (2007), Kristen and Granato (2007), or Lüdemann and Schwerdt (2013) for Germany; Dustmann et al. (2010) for the UK; as well as Dustmann et al. (2012) in a cross-country analysis of OECD countries. These studies have demonstrated the relevance of factors such as parental background or language proficiency as explanatory factors for migrants' worse skills. However, these studies do not consider individuals' transitions after leaving school.

My study is also related to the nascent literature on the role of aspirations and expectations in making educational decisions.[7] This literature has also found expectations to differ by dimensions such as gender (Fortin et al. 2015; Zafar 2013) or parental background (Boneva and Rauh 2017, Guyon and Huillery 2016). On the one hand, pupils from low-SES background were found to have lower educational aspirations than pupils from high-SES backgrounds who have similar ability (Guyon and Huillery 2016). Hoxby and Avery (2013) show that among high-ability students, those coming from low-SES parents are less likely to apply to selective colleges. On the other hand, there is the concern that some low-performing students have unrealistically high educational aspirations which also can lead to suboptimal outcomes (Goux et al. 2015). It also has been documented that migrants (as well as ethnic minorities) have very high educational ambitions, a pattern which holds for several industrialized countries (see Tjaden and Hunkler 2017, Salikutluk 2016, or Relikowski et al. 2012 for Germany; Jackson 2012 for the UK; Kao and Tienda 1995, 1998 for the U.S.; as

[4] Kaas and Manger (2012) use fictitious applications to student internships (i.e., more high-skilled individuals than school leavers who apply for apprenticeships) and find lower callback rates for applicants with Turkish-sounding names as compared to otherwise similar applicants with German-sounding names. However, this differential disappears if the applications also include reference letters from previous firms. Another experimental study by Weichselbaumer (2015) shows lower callback rates for female Turkish applicants wearing a headscarf, but little effects for female Turkish applicants without a headscarf.

[5] There also is the discussion on "pre-market" discrimination against migrants in the school system, see e.g. Sprietsma (2013) in the context of school grades in German language instruction. This issue is beyond the scope of this paper.

[6] As discussed in Section 3.5.1 below, I also show that pupils' *expected* discrimination in vocational training is not a driving factor for why migrants are more inclined towards pursing academic careers. This finding is in line with the existing literature for Germany, see Tjaden and Hunkler (2017) and Salikutluk (2016).

[7] See, among others, Stinebrickner and Stinebrickner (2014), Zafar (2013), Arcidiacono et al. (2012), Dominitz and Manski (1996) for the U.S.; Boneva and Rauh (2017) for England; as well as Kaufmann (2014) or Attanasio and Kaufmann (2014, 2017) for Mexico.

well as Guyon and Huillery 2016 or Brinbaum and Cebolla-Boado 2007 for France).[8] I extend this literature by analyzing the link between career plans and actual transitions and by showing that these plans can have very different effects for low- and high-skilled students.[9]

The rest of the paper is structured as follows. Section 3.2 gives a short description of the institutional features of the German education system and describes the different immigrant groups in Germany. Section 3.3 describes the data set. Section 3.4 shows the main empirical results and Section 3.5 presents additional analyses. Section 3.6 concludes.

3.2 Background

3.2.1 The German Education System

Germany has a tracked secondary school system in which children are typically tracked at age 10, after 4 years of primary school, based on their school performance. The three main tracks are lower secondary school (*Hauptschule*), which regularly finishes at age 15, middle secondary school (*Realschule*), which finishes at age 16, and higher secondary school (*Gymnasium*), which finishes at age 18/19. Secondary school leavers with lower or middle secondary degree have the option to apply for vocational training. School leavers with higher secondary degree additionally have the option to apply for tertiary education, but they can also apply for vocational training.

Tertiary education takes place at universities or universities of applied sciences. Entering tertiary education typically requires a degree from a higher secondary school track.[10] Depending on the subject of study, further entry restrictions may be based on the grade point average in the higher secondary school degree. Contrary e.g. to the U.S., there are no affirmative action policies such as quotas for specific minority groups.

The vocational training system in Germany consists of two main sectors: firm-based apprenticeship training and full-time vocational schools. In *apprenticeships* (the most frequent option), young individuals attend vocational schools during part of the week, and obtain within-firm training during the rest of the week, which is why this type of training is also called ”dual” vocational education. The apprenticeship market in principle works like a regular job market: school leavers apply for training positions and firms decide on which applicants they hire. Training is certified through a contract between the apprentice and the training firm. Apprenticeships typically last

[8] For the U.S., Cameron and Heckman (2001) or Lang and Manove (2011) report that individuals from Black and Hispanic families show higher educational performance (in terms of high school graduation and college attendance) than White students after controlling for family background characteristics and ability (AFQT test scores).

[9] A related analysis by Tjaden and Hunkler (2017) also uses the NEPS data and highlights the role of migrants' educational aspirations. However, as they use an earlier version of the data, their analysis is restricted to the subgroup of pupils in lower secondary school and they can only observe pupils' plans and not their actual transitions after school.

[10] Individuals without higher secondary degree may enter tertiary education if they have already completed vocational training. However, this is not (yet) an option for the individuals in the present data, as these have just left secondary school.

between 3 and 3.5 years, depending on the chosen occupation. Besides the apprenticeship system, there also exist *full-time vocational schools* (*Berufsfachschulen, Schulen des Gesundheitswesens*), which contain no within-firm training component. Full-time vocational schools offer only a limited number of occupations, typically in health and social services or assistant positions. Admission to full-time vocational schools is based on school degrees and grades and typically requires at least a middle secondary degree.

If a person leaves secondary school at age 15 or 16, and has not found a vocational training place (neither for a firm-based apprenticeship, nor at a full-time vocational school), he/she is not allowed in most Federal states to simply enter the labour market as an unqualified worker. Instead, he/she is then required to enter a measure in the so-called pre-vocational training system (*Übergangssystem*). As these measures last for only one year and do not award full vocational certificates, they are classified in my analyses as "No qualified training".

3.2.2 Immigrants in Germany

The present paper considers only pupils who are born in Germany in order to reduce possible concerns of unobserved heterogeneity as far as possible. Those pupils labeled "migrants" in this paper are therefore second- or third-generation migrants. As the NEPS survey includes pupils who were in 9th grade in the school year 2010/11, most of the individuals are born in 1994 or 1995. On the one hand, their families come from the classical guest worker countries (mainly Turkey, former Yugoslavia, Italy, Greece, Portugal, and Spain). In the 1950s and 1960s, workers from these countries were recruited by the then-West German government to fill shortages of workers in the industrial sector. These migrants were typically a negative selection in terms of skills and family background. On the other hand, there was another large wave of immigration in the late 1980s and early 1990s. Most of the immigrants at this time were "ethnic Germans" from the former Soviet Union and Eastern Europe (Glitz 2012), but also refugees from the civil wars in former Yugoslavia in the early 1990s.

3.3 Data

The empirical analysis relies on the Starting Cohort 4 of the National Educational Panel Study (NEPS).[11] This is an original sample of 16425 pupils who were in 9th grade during the school year 2010/11 and were followed up again in regular intervals. The sample is restricted to 15240 pupils in regular schools (excluding special needs schools), and further down to 13910 pupils who were born in Germany. "Migrants" are defined as those pupils who report a mother tongue other than German, while "natives" are those pupils that report only German as their mother tongue. Due to panel attrition, the number of individuals that are still observable in the data one year after

[11] See also Blossfeld et al. (2011) for a general overview of the different data sets associated with the NEPS.

finishing school is 10168.

The outcome variable is the respondent's activity in the first year after leaving secondary school.[12,13] I distinguish between three activities: tertiary education (at universities or universities of applied sciences), vocational education (at firm-based apprenticeships or full-time vocational schools), or no qualified training. The third category also includes one-year pre-vocational training programmes, which do not award full vocational degrees and are designed primarily for school leavers from lower and middle secondary schools who did not get a vocational training place.

The data provide exceptionally rich control variables. This includes standard parental background information, school degrees and school grades, performance in reading and mathematics test scores in 9th grade, and measures of access to social networks. Additionally, there is the advantage that the NEPS data are in the form of a clustered school sample. Thus, including 9th grade school fixed effects in the estimation allows to account for the fact that migrants and natives are possibly non-randomly sorted to specific schools, also conditional on the type of the school track. In other words, I only compare the outcomes of migrant and native pupils who attend the same schools in 9th grade. Given the data structure, all standard errors in the regressions will be clustered at the school level.

The survey asks detailed questions about pupils' career expectations and aspirations while in secondary school. Pupils are also surveyed retrospectively after having left school about whether and where they have applied for vocational training in a specific occupation. In order to characterize the aspired and expected occupations, and the occupation for which the person has applied, additional statistics are merged on the occupational level based on external data sources. These merges are done at the 3-digit level of the occupational classification used by the German Statistical Office. On the one hand, I merge information on the average educational levels of workers in the respective occupation. This information comes from a data set provided by Hausmann et al. (2015) and is based on German administrative data.[14] Moreover, for those pupils who have applied for firm-based vocational training, I merge information on the supply-demand ratio for training places in this occupation as a measure for the "competitiveness" of the vocational training market for these pupils. The information on supply-demand ratios comes from the Federal Institute for Vocational Education and Training (BIBB).[15]

[12] School years finish in the summer, and the survey usually takes place in the fall and winter (about 80 % are surveyed in the months from October to February). I control for interview month in the regressions.

[13] The survey in principle also follows up respondents for longer time periods, although there are some problems with panel attrition when considering longer time horizons. Section 3.5.3 considers activities in the second and third year after having left school for those pupils who leave without a higher secondary degree.

[14] The information comes from the Sample of Integrated Employment Biographies (SIAB) and is based on the years 2005-2010. The data are available at `http://doku.iab.de/fdz/reporte/2015/MR_09-15_Daten.zip`.

[15] These data are available at `https://www.bibb.de/de/75381.php`. Information on supply-demand ratios is not available for those training occupations (such as nurse or child care worker) which take place in the form of full-time vocational schooling. About 13 % of pupils who have applied for vocational training have applied for these occupations.

3.4 Results

3.4.1 Basic Facts

Table 3.1 presents descriptive evidence on the main outcomes, i.e. the realized transition in the first year after having finished secondary school, and the "raw" gaps in these transition rates between migrants and natives. As shown in Panel A, migrants have on average a higher probability to be without qualified training than natives, a lower probability to enter vocational training, and a lower probability to enter tertiary education. There are also striking gender differences – the migrants' higher risk of being without qualified training is much larger in magnitude among boys (+15.3 ppts.) than among girls (+8 ppts.).

Table 3.1: Transitions in the first year after leaving secondary school

	Boys			Girls		
	No qualified training	Vocational education	Tertiary education	No qualified training	Vocational education	Tertiary education
A. All school leavers						
Migrants	0.415	0.388	0.197	0.410	0.392	0.198
Natives	0.262	0.509	0.229	0.330	0.407	0.263
Migrant-Native Gap	0.153***	-0.121***	-0.032	0.080***	-0.015	-0.065***
	(0.022)	(0.022)	(0.020)	(0.019)	(0.021)	(0.018)
N	5090	5090	5090	5078	5078	5078
B. School leavers without higher secondary degree						
Migrants	0.492	0.508	-	0.477	0.523	-
Natives	0.287	0.713	-	0.354	0.646	-
Migrant-Native Gap	0.205***	-0.205***	-	0.122***	-0.122***	-
	(0.027)	(0.027)	-	(0.025)	(0.025)	-
N	3013	3013	-	2450	2450	-
C. School leavers with higher secondary degree						
Migrants	0.261	0.147	0.592	0.311	0.200	0.489
Natives	0.228	0.227	0.545	0.309	0.205	0.487
Migrant-Native Gap	0.034	-0.080***	0.047	0.003	-0.005	0.002
	(0.032)	(0.026)	(0.037)	(0.026)	(0.025)	(0.028)
N	2077	2077	2077	2628	2628	2628

Note: The table shows the share of migrant and native pupils who pursue a certain activity in the first year after leaving secondary school. Migrant-native gaps are based on OLS regressions with standard errors in parentheses clustered at the school level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC4, own calculation.

Given that migrants and natives differ in their schooling history and skill endowments before leaving school (as will be documented in more detail in Section 3.4.2. below), it is also important to analyze transitions conditional on school degrees and skills. While Panel A of Table 3.1 has shown the results when pooling school leavers with all types of secondary school degrees, Panels

B and C present the results separately for pupils without and with higher secondary degrees, respectively. In Germany's tracked school system, pupils without higher secondary degree do not have the option to attend tertiary education directly after school, and vocational education is their only chance to achieve qualified post-school training. Nevertheless, it appears from Panel B that a relatively large share of these less skilled school leavers fails to enter qualified training in the first year after school. The migrant-native gap is stronger among less skilled boys (+20.5 ppts.) than among less skilled girls (+12.2 ppts.).

Finally, Panel C of Table 3.1 shows the results when restricting the sample to school leavers with a higher secondary degree, who have the option to enter tertiary education after school. Among the high-skilled boys, migrants are again less likely to enter vocational training and more likely to enter tertiary education. Among high-skilled girls, there are little differences between migrants and natives.

Figures 3.1a and 3.1b plot higher secondary graduation rates for natives and migrants holding constant 9th grade cognitive skills, with the x-axis showing the average percentile of the pupil's reading and mathematics test scores.[16] As expected, the share who attend tertiary education is increasing steeply in skill, while the share who have no qualified training or vocational education decreases with skill. Overall, the figures document a striking "polarization" of migrants' educational choices: compared to natives of the same skill level, migrants are both more likely to end without qualified training *and* more likely to attend tertiary education, and less likely to attend vocational education. In line with the analyses above, the migrant-native gap of not entering qualified training is much more pronounced among the less skilled, and then becomes much smaller in magnitude when moving further up the skill distribution. These patterns are more pronounced among boys. In particular, less skilled migrant boys have much lower entry rates into vocational training than less skilled native boys (tertiary education plays generally a small role for the less skilled). For girls, these gaps go in a similar direction, but are smaller in magnitude.

3.4.2 Differences in Characteristics Between Migrant and Native School Leavers

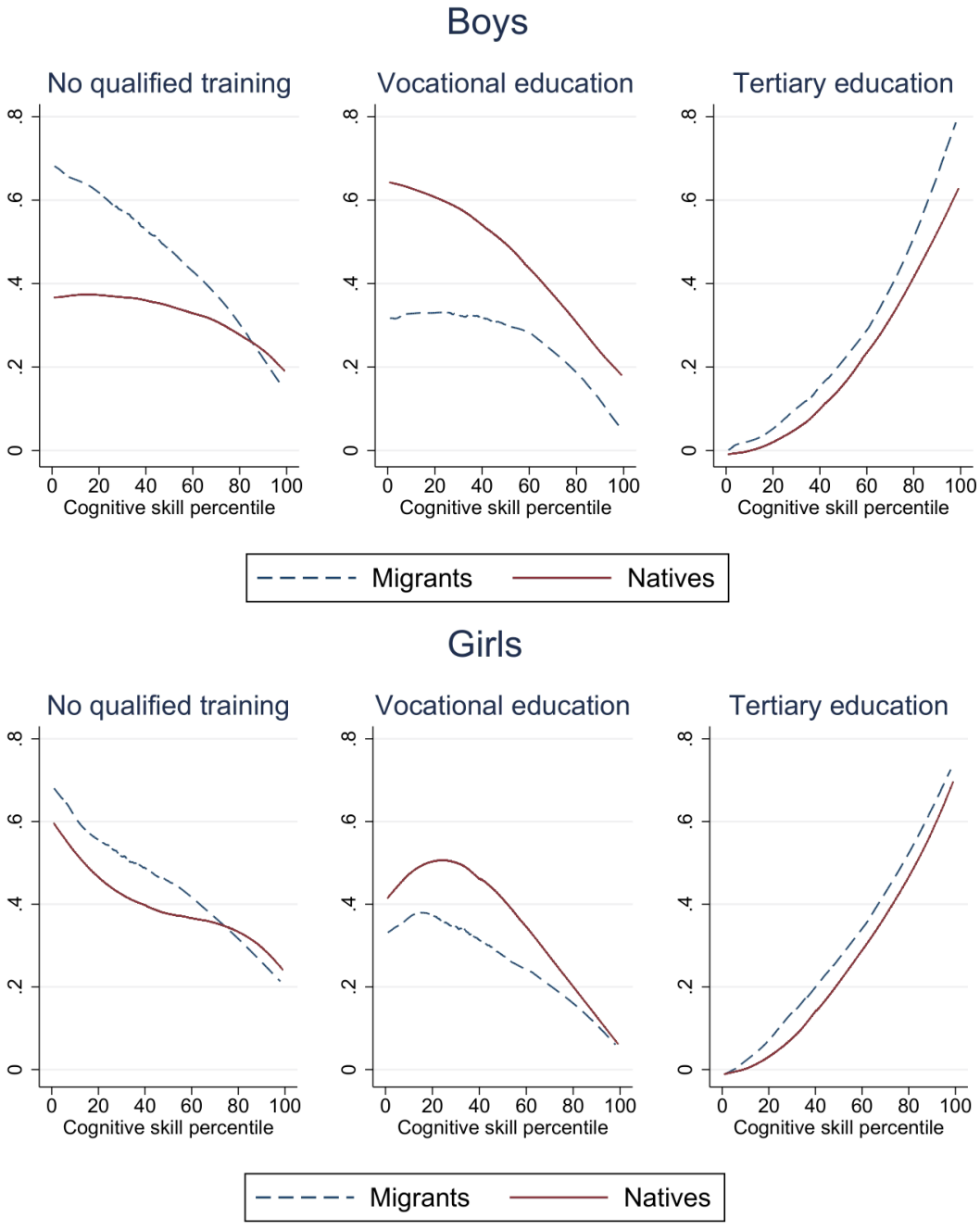
Differences in Background and Skills

The aim of the analysis is to show to what extent the large "raw" differences documented above can be explained by differences in characteristics between migrant and native school-leavers. I first consider detailed measures of parental background, school degrees, cognitive and noncognitive skills, as well as variables at the school and regional level. Table 3.2 shows selected descriptive statistics of these variables, separately by migrant status and gender.[17] First consider the parental background variables. About 70 % of the German pupils have a parent with a vocational de-

[16] Percentiles are defined for the pooled sample of migrants and natives, but separately by gender.

[17] Separate statistics of pupils without and with higher secondary degree are presented in Tables 3.A1a and 3.A1b in the Appendix.

Figure 3.1: Transitions by percentile of 9th grade cognitive skill



Note: The graph shows the share of pupils who pursue a certain activity in the first year after leaving secondary school, depending on the pupil's skill level in 9th grade. Results from a locally weighted regression are shown. The cognitive skill percentile is obtained as the average of a pupil's percentiles in 9th grade reading and mathematics test scores. Percentiles are defined for the pooled sample of migrants and natives. Source: NEPS SC4, own calculation.

gree, compared to only about 40 % for migrants. In contrast, migrant pupils have a much higher percentage of parents without any post-schooling degree.

The pupils' school degree is another key predictor of post-schooling trajectories.[18] Not only does entry to tertiary education require a higher secondary degree, but also in the apprenticeship market firms tend to give priority to school-leavers with better school degrees and cognitive skills.[19] Migrant pupils are much less likely than German pupils to leave school with a higher secondary degree (–10.5 ppts. for boys, and –14.5 ppts. for girls). Another skill indicator is the performance in reading and mathematics tests which were conducted in the NEPS survey when the pupils attended 9th grade. Migrants are behind natives in the order of about half a standard deviation in both reading and mathematics test scores.

Table 3.2 also confirms previous findings in the literature on gender inequalities in education – in particular, the better performance of girls in achieving higher school degrees and their advantage in reading, as well as boys' advantage in mathematics.[20] These gender differences are present among both natives and migrants. The migrant-native gaps in human capital before leaving school are either similar for the genders, or in some cases slightly larger in magnitude among girls.

Moreover, I control for whether the pupil reads a lot in his/her spare time or whether he/she plays a musical instrument. The share reporting these academically demanding activities is much higher among girls than among boys (regardless of migrant status), but since it is particularly high among native girls, the ethnic gaps are higher among girls than boys for these variables. I also consider whether the pupil is a member of a sports club or a voluntary social service organization. Such activities can on the one hand help the person to acquire contacts who provide information on open positions. Moreover, these activities can signal social skills to employers that would otherwise be unobserved.[21] Migrant boys are less likely to participate in voluntary service organizations than native boys, while migrant girls are less likely to participate in sports clubs than native girls.

Table 3.2 further shows a number of regional characteristics. Since apprenticeship markets and the supply of tertiary educational institutions differ considerably across different regions in

[18] I distinguish between five secondary school degrees: basic lower secondary degree (*Hauptschulabschluss*), advanced lower secondary degree (*erweiterter Hauptschulabschluss*), middle secondary degree (*Mittlerer Schulabschluss*), as well as two types of higher secondary degree: *Fachhochschulreife* and *Abitur*, with the former only granting access to universities of applied sciences.

[19] Various studies document the correlation between such ability signals and the chance of applicants to be invited for a job interview, and/or to be hired for the apprenticeship position, see e.g. Hunkler (2014). In an experimental study, Piopiunik et al. (2018) show part of these these correlations also seem to be causal. Using fictitious applications for apprenticeships, applicants who are randomly assigned better school grades and IT skills have higher chances to be invited for a job interview.

[20] See, among others, Autor et al. (2016), Fortin et al. (2015), Riphahn and Schwientek (2017), Buchmann et al. (2008), Goldin et al. (2006).

[21] In an experimental study using fictitious school leavers' applications for apprenticeships, Piopiunik et al. (2018) find that applicants who signal social skills by social volunteering have a 37 ppts. higher probability to be invited for a job interview than otherwise identical applicants. In contrast, no effect is found for participation in sports clubs.

Table 3.2: Selected background characteristics: Parental background, skills, and regional variables

	Boys				Girls			
	Migrants	Natives	Diff.		Migrants	Natives	Diff.	
Parental Education:								
Vocational	.389	.703	-.314	***	.434	.684	-.249	***
Tertiary	.137	.226	-.089	***	.126	.244	-.118	***
No postsec.	.474	.071	.403	***	.439	.072	.367	***
Grew up with both parents	.747	.734	.013		.741	.734	.007	
Number of siblings	1.664	1.328	.336	***	1.751	1.3	.451	***
Secondary school degree:								
No school degree	.034	.019	.015	**	.024	.014	.01	*
Lower sec. (basic)	.215	.128	.087	***	.159	.085	.073	***
Lower sec. (advanced)	.129	.091	.038	***	.112	.058	.054	***
Middle sec.	.288	.342	-.053	**	.3	.302	-.002	
Higher sec. (FHR)	.078	.06	.017		.086	.076	.01	
Higher sec. (Abitur)	.256	.361	-.105	***	.319	.465	-.145	***
9th Grade Test Scores:								
Reading	-.621	-.089	-.532	***	-.381	.213	-.594	***
Mathematics	-.271	.217	-.488	***	-.576	-.076	-.5	***
Reads a lot in his/her spare time	.252	.283	-.031	*	.476	.571	-.095	***
Plays musical instrument	.263	.292	-.029		.363	.415	-.051	***
Member of a sports club	.623	.651	-.028		.428	.585	-.157	***
Member of a voluntary service club	.073	.152	-.079	***	.067	.088	-.02	**
Lives in a big city	.344	.206	.138	***	.321	.219	.102	***
University present in district	.362	.233	.129	***	.317	.246	.071	**
District with high youth unempl. rate	.42	.406	.015		.436	.416	.021	
N	735	4355			864	4214		

Note: To test whether the migrant-native gap for a certain variable is statistically significant, a bivariate OLS regression is run with standard errors in parentheses clustered at the school level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC4, own calculation.

Germany, differences in the regional allocation of migrants and natives have potentially important effects on postsecondary educational choices.[22] Since school-leavers make their decision at a relatively young age of 15/16 (when leaving with a lower/middle secondary degree) or at age 18/19 (when leaving with a higher secondary degree), credit constraints and family ties are possibly relevant and impede regional mobility. Table 3.2 shows that migrant pupils are much more likely to live in big cities (which have a lower concentration of firms offering apprenticeship places), and they are more likely to live in districts in which a tertiary educational institution is present.[23,24] These factors, ceteris paribus, should contribute to migrants' lower representation in the vocational training system, and a higher tendency to apply for tertiary education.

[22] Spieß and Wrolich (2010) provide evidence for Germany that distance to the next university affects enrollment in

Finally, the regressions will also control for school fixed effects to proxy for unobserved school-specific factors affecting transition rates. In Germany's tracked school system, pupils are sorted by academic ability already at age 10, which should result in relatively large segregation across schools, and also between migrants and natives. This conjecture is supported by findings in Dustmann et al. (2012), who show that among all European countries, Germany has the largest migrant-native difference in terms of school quality (measured by peers' test scores).[25] In the NEPS data, I find that migrants are attending schools with peers whose 9th grade reading test scores are about 0.3 standard deviations below the peers of native pupils. Note, however, that with the present data, the effect of schools can't be distinguished from the effect of the regional variables in the same regression, because the regional variables are merged based on the district of the school. I thus can't rule out that part of the school fixed effect in fact captures neighborhood characteristics on a finer regional level.

Differences in Career Plans

I next turn to various variables describing pupils' career plans. First consider occupational aspirations and expectations. For *aspirations*, pupils are asked to state their occupational preferences disregarding any possible constraints ("If you could decide just by yourself, in which occupation do you want to work?"). In contrast, pupils' *expectations* about the future ("In which occupation do you think you will work later?") reflect not only their preferences, but also subjective constraints such as ability or financial constraints.

Figure 3.2 shows how career plans differ between migrant and native pupils when holding constant 9th grade cognitive skill. Compared to similarly skilled natives, migrants show both higher aspirations (Figure 3.2a) and higher expectations (Figure 3.2b) to work in tertiary occupations.[26] This gap is present along the whole skill distribution. For both migrants and natives, the share of pupils expecting to work in a tertiary occupation is generally lower than the share aspiring to work in a tertiary occupation, suggesting that subjective constraints are important for a few pupils. There are, however, also some gender differences. Migrant boys have both high aspirations *and* high expectations. Migrant girls have high aspirations, but their expectations are lower in comparison.

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tertiary education. Kleinert and Kruppe (2012) analyze regional differences in apprenticeship markets.

[23] Those regions in Germany which historically have a larger share of migrants (big cities, in particular the Ruhr area) have a lower supply-demand ratio for apprenticeship places, while many regions with a more favourable supply-demand ratio (such as rural areas in Bavaria or parts of East Germany) have a lower share of migrants.

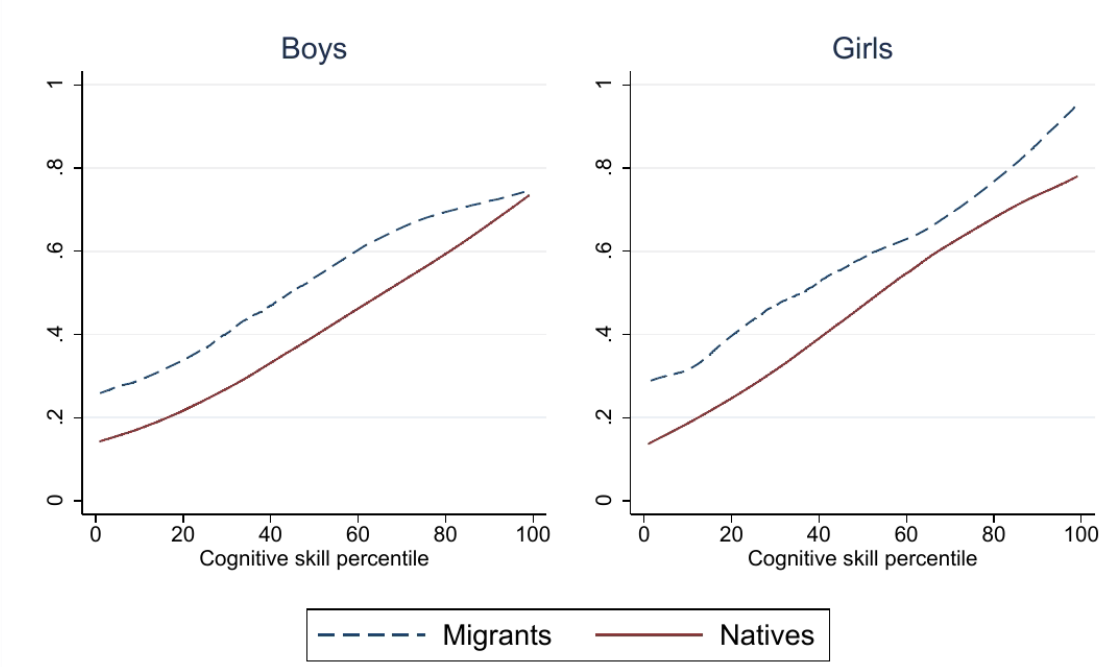
[24] See also Glitz (2014) for an extensive analysis of regional and workplace segregation in Germany.

[25] Studies for other countries have also demonstrated the importance of school quality, such as Fryer and Levitt (2004) or Hanushek and Rivkin (2009) for the Black-White test score gap in the U.S., or Dustmann et al. (2010) for the test score gap between White British and migrant pupils in the UK.

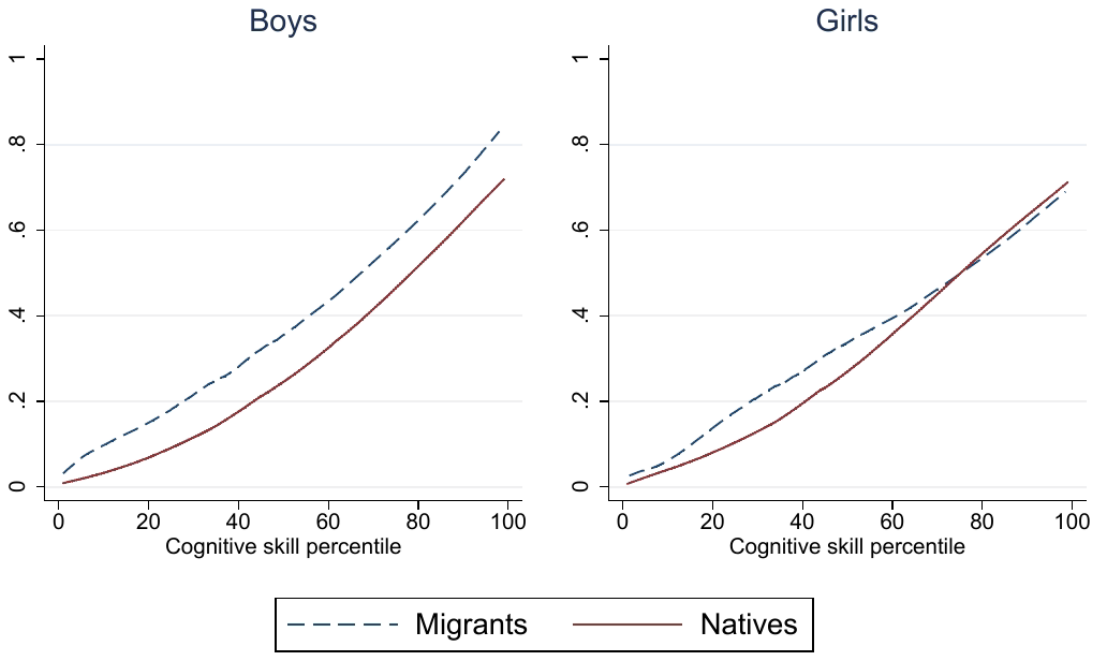
[26] An occupation is classified as "tertiary" if the relative majority of workers holds either a tertiary or a higher secondary school degree. As discussed in Section 3.3, this information is merged based on administrative data.

Figure 3.2: Career plans, by percentile of 9th grade cognitive skill

A: Pupil aspires to work in a tertiary occupation



B: Pupil expects to work in a tertiary occupation



Note: The graph shows the share of migrant and native pupils who aspire (Panel A) or expect (Panel B) to work in a tertiary occupation, depending on the pupil's 9th grade skill level. An occupation is classified as tertiary if the majority of workers holds a tertiary degree. Skill shares by occupation are merged at the 3-digit occupational level based on administrative data in Hausmann et al. (2015). The graph shows results from a locally weighted regression. The cognitive skill percentile is obtained as the average of a pupil's percentiles in 9th grade reading and mathematics test scores. Percentiles are defined for the pooled sample of migrants and natives. Source: NEPS SC4, own calculation.

Table 3.3: Career plans

	Boys						Girls					
	Mig-rants	Na-tives	Raw Diff.		Cond. Diff.		Mig-rants	Na-tives	Raw Diff.		Cond. Diff.	
Parental educational aspirations:												
Academic	.435	.322	.113	***	.163	***	.472	.379	.093	***	.194	***
Vocational	.378	.473	-.095	***	-.122	***	.38	.409	-.03		-.123	***
None	.186	.205	-.018		-.041	**	.148	.212	-.064	***	-.07	**
Pupil's occupational aspirations:												
Tertiary	.427	.407	.021		.078	***	.475	.466	.009		.09	***
Vocational	.43	.464	-.034		-.065	***	.424	.451	-.028		-.087	***
None	.143	.129	.014		-.012		.102	.083	.019	*	-.002	
Pupil's occupational expectations:												
Tertiary	.263	.282	-.019		.051	***	.233	.299	-.066	***	.027	***
Vocational	.533	.561	-.027		-.063	***	.624	.57	.054	***	-.014	***
None	.203	.158	.045	***	.011		.144	.131	.013		-.012	
Aspires to complete higher sec. degree	.543	.543	0		.097	***	.591	.647	-.056	**	.078	***
Expects to complete higher sec. degree	.356	.425	-.069	***	.043	***	.402	.517	-.115	***	.035	***
Plans to apply for voc. training after school	.448	.437	.01		-.036	**	.42	.381	.039		-.041	*
Done a voluntary internship during school	.107	.152	-.044	***	-.043	***	.111	.133	-.022	*	-.02	***
Has applied for voc. training	.597	.621	-.024		-.055	***	.541	.524	.017		-.055	***
Knows someone who gives info on voc. tr.	.58	.72	-.14	***	-.097	***	.718	.785	-.068	***	-.03	***
Knows someone who can help with application	.442	.623	-.18	***	-.083	***	.582	.739	-.157	***	-.046	***
Supply-demand ratio in occ. for which applied (if any)	.911	.922	-.01	**	-.01	*	.897	.903	-.006		-.016	*
N	735	4355					864	4214				

Note: For each variable, the column entitled "raw difference" shows the mean difference in the respective variable between migrants and natives. The column entitled "conditional difference" shows differences regression-adjusted for parental background, skills, and school fixed effects. To test whether the migrant-native gap for a certain variable is statistically significant, a bivariate OLS regression ("raw difference") or a multivariate OLS regression ("conditional difference") is run with standard errors in parentheses clustered at the school level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC4, own calculation.

Table 3.3 corroborates this evidence by considering a larger set of variables describing pupils' career plans.[27] This table also shows the migrant-native differences both unconditionally and conditional on background characteristics and skills (similar to Figure 3.2 which controlled for test scores as a single skill metric).[28]

Migrants' parents show much higher aspirations that their children will attend a university later on (and, correspondingly, a lower aspiration for vocational education).[29] Interestingly, this holds for both boys and girls, even though many migrant families come from cultures with more conservative gender role models. There are also interesting patterns for the plans of the pupils themselves. For example, compared to native boys (girls) of similar background and skills, migrant boys (girls) are 5.1 ppts. (2.7 ppts.) more likely to expect to work in tertiary occupations. Comparing the "conditional" and "unconditional" columns, migrants' more academic aspirations and expectations become more pronounced when controlling for the fact that migrants typically have more disadvantaged family backgrounds and are less skilled than native pupils.[30]

Table 3.4 compares the fields of the pupils' expected occupation. Among less skilled boys, occupations in the category "production and construction" are most frequent. However, migrant boys tend to expect these occupations less frequently than native boys and more often expect to work in service sector occupations such as "sales and gastronomy" or "management, law, and administration". This also holds for girls, albeit to a weaker extent.

The migrants' more academically oriented career plans are mirrored by a lower inclination towards vocational training. In particular, while still in school, migrants are less likely to report they plan to apply for vocational training, and after school they are also less likely to actually have applied. Moreover, migrants also are less likely to have completed a voluntary firm internship while in school.[31] Related to this is the access to social networks, measured by whether the pupil knows someone who can provide information about open apprenticeship positions or who can help with writing an application. Migrant youth (in particular, migrant boys) report to receive much less support than native youth.

Importantly, as shown in Appendix Table 3.A2a, the migrants' more ambitious career expectations and aspirations are also present among those school leavers who leave school without a higher secondary degree. In Germany's tracked school system, these less skilled pupils do not have the option to attend tertiary education, and vocational training is their only viable chance for

[27] This table again shows the results for all school leavers pooled, while separate statistics for school leavers without and with higher secondary degree are shown in Appendix Tables 3.A2a and 3.A2b.

[28] Specifically, the columns named "conditional difference" in Table 3.3 show the coefficient of a migrant dummy from a regression of the respective variable on the migrant dummy, parental background, skills, and school fixed effects.

[29] Information on the parents' expectations about their children is not available.

[30] This is most salient for expectations: the migrant-native difference in expecting a tertiary occupation increases from -1.9 ppts. for boys (unconditionally) to 5.1 ppts. (conditionally).

[31] Many pupils are required to do an internship by their school, and there is no migrant-native difference in compulsory internships.

Table 3.4: Occupational fields (expected occupation)

	Boys		Girls	
	Migrants	Natives	Migrants	Natives
A. School leavers without higher secondary degree				
Military	1.9	2.5	0.2	0.4
Agriculture	1.9	3.6	1.4	3.6
Production, Construction	47.1	56.8	5.2	8.7
Natural Sciences, IT	6.4	6.6	0.9	1.4
Transport, Logistics, Security	6.1	7.8	2.4	2.9
Sales, Gastronomy	11.6	6.8	23.6	16.8
Management, Law, Administration	13.3	7.4	17.7	18.3
Health, Social Services, Education	7.2	6.2	46.9	45.5
Media, Culture, Literature	4.4	2.5	1.7	2.4
N	490	2523	514	1936
B. School leavers with higher secondary degree				
Military	0.4	1.8	0	0.5
Agriculture	0.4	1.3	0	0.9
Production, Construction	19.6	25.9	6.0	9.1
Natural Sciences, IT	12.4	15.3	5.1	4.7
Transport, Logistics, Security	8.4	6.9	4.1	3.6
Sales, Gastronomy	4.9	4.9	12.0	6.4
Management, Law, Administration	30.7	19.5	27.2	22.4
Health, Social Services, Education	19.1	16.3	34.5	41.9
Media, Culture, Literature	4.0	8.2	11.1	10.5
N	245	1832	350	2278

Note: The table shows the share of migrant and native pupils who report that they expect to work in a certain occupational field in the future. The fields follow the 1-digit KldB 2010 occupational classification by the German Statsitical Office. Source: NEPS SC4, own calculation.

qualified training. Even among this group, there is a larger share of migrant students who report that they did not apply for vocational training.

Moreover, even if migrants actually do apply for vocational training, they tend to select more competitive occupations than natives. This is also illustrated in the last row of Table 3.3, which shows (for those who have applied for vocational training) the supply-demand-ratio for vocational training places in the respective occupation the pupil has applied for.[32] Migrants apply for occupations with a lower supply of training places relative to demand. Of course this does not imply that migrant boys have a higher preference for competition per se. Rather, this may again a by-product of the occupational preferences described above (see Appendix Table 3.4) as migrants are less

[32]As discussed in Section 3.3, this information is based on merged data from the Federal Institute for Vocational Education and Training (BIBB), see `https://www.bibb.de/de/75381.php`.

likely to aim for production and crafts occupations (where the supply-demand-ratio is higher) and more likely to apply for occupations in the service sector (with a less favourable supply-demand-ratio).

3.4.3 Contribution of Characteristics to the Migrant-Native Gaps

Returning now to the paper's main question of what can explain migrant-native gaps in post-school transitions, Table 3.5 shows how these gaps change after successively controlling for various blocks of variables.

Starting from a "raw" model (Table 3.5, columns 1 and 5), I first add parental background variables (Table 3.5, columns 2 and 6). The migrants' less favourable parental background completely explains their lower chance of entering tertiary education and a small part of their higher risk of remaining without qualified training. The next specification (columns 3 and 7) further conditions on skills (school grades, cognitive test scores in reading and mathematics, and noncognitive skills) as well as school fixed effects. For boys, this generates a polarization of migrants' educational choices: compared to natives of similar background and skill, migrants are more likely to remain without qualified training (+7.6 ppts.), less likely to attend vocational education (-11.5 ppts.) and more likely to attend academic education (+3.9 ppts). For girls, parental background and skills explain the complete migrant-native differential in terms of remaining without qualified training. However, similar to migrant boys, migrant girls also show a higher rate of tertiary attendance (+2.7 ppts.) and a lower rate of vocational attendance (-2.0 ppts.) than their background and skills would predict. Finally, controlling for career plans (Table 3.5, columns 4 and 8) explains a large part of the remaining gaps for all three transitions. While among boys, there remains an "unexplained" gap in the order of 4.3 ppts. when considering the risk of remaining without qualified training, it is substantially smaller in magnitude than without controlling for career plans.

Table 3.6 then documents that the previous results, which have been obtained for the pooled sample of all school leavers, are actually driven by very different patterns in the bottom and the top of the skill distribution. This table shows separate estimations by whether a pupil left school without a higher secondary degree (in Panel A) or with a higher secondary degree (in Panel B). First consider the results for less skilled individuals who do not have the option to attend tertiary education. As discussed above, the migrant-native gaps are particularly large in this group (+20.5 ppts. for boys and +12.2 ppts. for girls). For boys, the migrants' higher risk of remaining without qualified training can only partly be explained by parental background and skills (Table 3.6, Panel A, column 3). However, the remaining gap can be explained to a large extent by the fact that less skilled migrants have more ambitious career plans and are applying to vocational education to a much lesser extent than less skilled natives. After controlling for all characteristics, there remains a insignificant "residual" migrant-native gap of +4.8 ppts. For girls, conditioning on parental background and skills is sufficient to explain most of the migrants' higher risk of remaining without qualified training (Table 3.6, Panel A, column 7).

Table 3.5: Migrant-native gaps in transitions, first year after secondary school (all school leavers)

	Boys				Girls			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimated gap between migrants and natives in the transition to...								
No qualified training	0.153***	0.138***	0.076***	0.043*	0.080***	0.062***	-0.007	-0.002
	(0.022)	(0.022)	(0.023)	(0.022)	(0.019)	(0.019)	(0.021)	(0.020)
Vocational training	-0.121***	-0.137***	-0.115***	-0.059***	-0.015	-0.041**	-0.020	-0.001
	(0.022)	(0.022)	(0.022)	(0.021)	(0.021)	(0.021)	(0.020)	(0.019)
Tertiary education	-0.032	-0.001	0.039***	0.016	-0.065***	-0.021	0.027*	0.003
	(0.020	(0.019)	(0.014)	(0.014)	(0.018)	(0.016)	(0.014)	(0.014)
Parental background		✓	✓	✓		✓	✓	✓
Skills and school fixed effects			✓	✓			✓	✓
Career plans				✓				✓
N	5090	5090	5090	5090	5078	5078	5078	5078

Note: This table is based on Linear Probability Models of whether a pupil makes the respective transition in the first year after leaving secondary school, controlling for a migrant dummy and different sets of covariates. Standard errors in parentheses, clustered at the school level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC4, own calculation.

Table 3.6: Migrant-native gaps in transitions, first year after secondary school (by school degree)

	Boys				Girls			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Pupils without higher secondary degree								
Estimated gap between migrants and natives in the transition to...								
No qualified training	0.205***	0.187***	0.103***	0.048	0.122***	0.104***	0.031	0.028
	(0.027)	(0.027)	(0.031)	(0.029)	(0.025)	(0.026)	(0.030)	(0.030)
Vocational education	-0.205***	-0.187***	-0.103***	-0.048	-0.122***	-0.104***	-0.031	-0.028
	(0.027)	(0.027)	(0.031)	(0.029)	(0.025)	(0.026)	(0.030)	(0.030)
N	3013	3013	3013	3013	2450	2450	2450	2450
B. Pupils with higher secondary degree								
Estimated gap between migrants and natives in the transition to...								
No qualified training	0.034	0.035	0.007	0.006	0.003	0.005	-0.063*	-0.046
	(0.032)	(0.034)	(0.039)	(0.039)	(0.026)	(0.027)	(0.034)	(0.034)
Vocational education	-0.080***	-0.098***	-0.119***	-0.055*	-0.005	-0.018	-0.003	0.036
	(0.026)	(0.026)	(0.029)	(0.028)	(0.025)	(0.026)	(0.029)	(0.024)
Tertiary education	0.047	0.063*	0.112***	0.049	0.002	0.012	0.066*	0.010
	(0.037)	(0.038)	(0.041)	(0.041)	(0.028)	(0.029)	(0.034)	(0.033)
N	2077	2077	2077	2077	2628	2628	2628	2628
Parental background		✓	✓	✓		✓	✓	✓
Skills and school FE			✓	✓			✓	✓
Career plans				✓				✓

Note: This table is based on Linear Probability Models of whether a pupil makes the respective transition in the first year after leaving secondary school, controlling for a migrant dummy and different sets of covariates. Standard errors in parentheses, clustered at the school level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC4, own calculation.

The patterns look different when considering school leavers with a higher secondary degree in Panel B of Table 3.6. For this group, the migrant-native difference in taking up tertiary education turns strongly positive when parental background and skills are added to the regression (to +11.2 ppts. for boys, and +6.6 ppts. for girls). In other words, high-skilled migrant school leavers of both genders "swim upstream" and have much higher tertiary education attendance rates than their family background and cognitive skills would predict. The migrants' more ambitious career plans can to a large part resolve this puzzle.

An alternative strategy is to conduct a Blinder-Oaxaca decomposition which estimates the contribution of each block of variables holding the others fixed.[33] Results are shown in Appendix Table 3.A3. For pupils without higher secondary degree, the migrants' higher risk of remaining without tertiary education (+20.5 ppts. for boys and +12.2 ppts for girls) is explained both by cognitive skills (+6.8 for boys, +7.1 ppts. for girls) and career plans (+7.2 ppts. for boys, +3.5 ppts. for girls). As discussed above, there is an unexplained gap for boys, but almost all of the gaps are explained for girls. For pupils with higher secondary degree, migrants' worse endowment with cognitive skills works against them pursuing tertiary education (in the order of -2.8 ppts. for boys and -5.7 ppts. for girls), while their more academic career plans work in the opposite direction (with an effect of +4.2 ppts. for boys, and +3.6 ppts. for girls).

To sum up, I find that while migrants are more likely to have academic career aspirations and expectations and are less likely to apply for vocational training, these differences have very different effects for pupils at the bottom and the top of the skill distribution. One the one hand, the high aspirations tend to divert less skilled migrants (in particular boys) from vocational training as a more viable alternative, resulting in them "swimming downstream" and having a higher risk of remaining without qualified training than similarly skilled natives. On the other hand, high aspirations allow the high-skilled migrants to "swim upstream" and participate in tertiary education to a greater extent than their skills would predict.

3.5 Further Analyses

3.5.1 What Explains the Differences in Career Plans?

This section will examine a number of potential explanations for the different career aspirations and expectations of migrants, namely 1) that migrants expect higher labour market returns to tertiary compared to vocational education, 2) that migrants expect discrimination in the apprenticeship market, 3) that migrants have a higher probability to returning back to their home countries, and 4) that migrants overestimate their own abilities ("overconfidence").

[33] While this is a widely used approach in these settings, it is not entirely clear whether it is the correct approach since the effect of one variable could also work indirectly through its effect on other covariates. For example, as parental background likely affects school choice and educational aspirations, considering only the "ceteris paribus" effect of parental background will understate its impact.

Expected Labour Market Returns to Education. The first possible explanation is that migrants differ from natives in their expectations of the returns to different post-schooling pathways. The classic economic model of Becker (1964) views education as an investment in human capital, where individuals trade-off the expected returns and costs of different educational paths. A growing literature has investigated the effect of students' subjective expected returns on their actual educational choices, and typically found that students indeed do sort based on expected returns. Expected returns to education were also found to differ by parental background, but less is known about migrant-native differences in expected returns.[34] In the NEPS survey, pupils are asked about what they think are the average earnings in six different occupations, including occupations which require a tertiary degree (medical doctor and teacher) as well as occupations that usually need vocational education (car mechatronic, bank clerk, hairdresser, and nurse). I use the average difference of the expected earnings of tertiary and vocational occupations as a proxy for the expected returns to tertiary education.[35]

The measure for expected returns in the present data also has a number of limitations, though. While the survey asks pupils about what they think an average worker in a certain occupation earns, a probably more relevant question would be to ask pupils which earnings *they personally* expect if they would work in this occupation. For example, it is possible that migrants expect that because of discrimination, the earnings penalty of migrants is stronger in vocational compared to academic occupations. Finally, there is no information on expected non-monetary returns or expected costs of different educational paths.[36]

Keeping those caveats in mind, I plot in Figure 3.3 the distributions of expected returns. The graph shows that almost all respondents understand the fact that workers in tertiary occupations on average earn more than those in vocational occupations, but that there is still considerable variation across individuals. For example, the 10th percentile of the distribution of expected returns (pooled for all respondents) is 17 %, the median is 67 %, and the 90th percentile is 165 %. Moreover, the distribution of expected returns among the migrants is visibly shifted to the right of the distribution among the natives, i.e. migrants tend to expect higher returns to tertiary occupations than natives. Further analyses show that migrant boys' (girls') expected returns are 13.1 ppts. (8.7 ppts.) higher than comparable natives' expected returns.

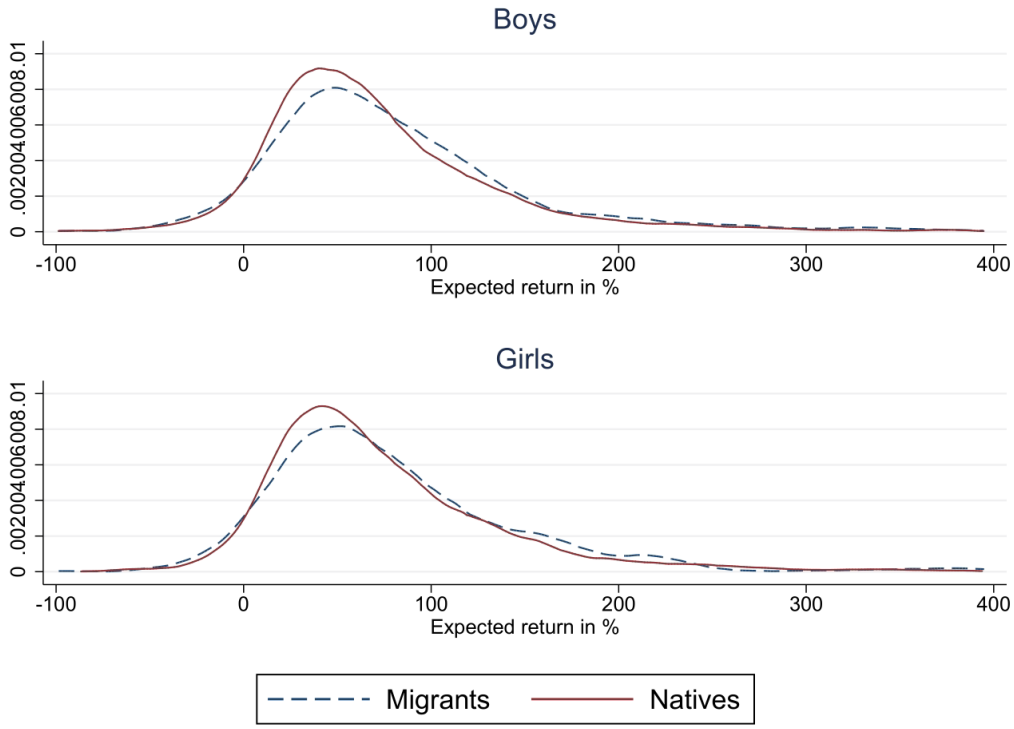
Expected Discrimination. It is also possible that migrants, if they expect discrimination by firms in the apprenticeship market, have a lower incentive to put in effort searching for an

[34] See e.g. Dominitz and Manski (1996), Arcidiacono et al. (2012) for the US; Boneva and Rauh (2017) for England; or Attanasio and Kaufmann (2014, 2017) as well as Kaufmann (2014) for Mexico.

[35] More precisely, the return variable is constructed as $\frac{(Exp_{Med}+Exp_{Teacher})/2-(Exp_{CarMech}+Exp_{Bank}+Exp_{Nurse}+Exp_{Hairdr})/4}{(Exp_{CarMech}+Exp_{Bank}+Exp_{Nurse}+Exp_{Hairdr})/4}$. Using alternative weights, such as assuming that the expected earnings of car mechanics matter only for boys and expected earnings of nurses and hairdressers matter only for girls, gave very similar results.

[36] For example, Zafar (2013) or Boneva and Rauh (2017) find that expected non-monetary returns to education, such as job satisfaction, work-family balance, or social life, play a key role in explaining schooling decisions.

Figure 3.3: Distributions of subjective expected mean earnings differences of tertiary vs. vocational occupations



Note: The graph shows kernel density plots of migrant and native pupils' subjective expected returns to tertiary vs. vocational occupations (in %). Expected returns are based on pupils' subjective assessment of earnings in tertiary and vocational occupations. Further descriptions see text. Source: NEPS SC4, own calculation.

apprenticeship place, and instead focus on continuing general schooling to improve their chances in the labour market (Tjaden and Hunkler 2017, Heath and Brinbaum 2007).[37] Note that for this argument, it is the *perceived* discrimination that matters, regardless of whether discrimination actually takes place or not. In the present data, expected discrimination is proxied by the question: *"Do you think it is more difficult to find a vocational training place for persons with a foreign sounding name?"*, with the answer options "Yes", "Rather yes", "Rather no", "No", and "Don't know". 35% of migrant pupils answered "Yes" or "Rather yes", compared to 27% of natives.

The Intention to Leave Germany. Some migrants only plan to stay in their host country for a few years before returning to their home country, which has possible effects on their investment in human capital (Dustmann and Görlach 2016, Dustmann and Glitz 2011). In particular, if a migrant intends to leave the host country in the foreseeable future, she may be more inclined to invest in academic skills, which are more portable across countries, rather than in specific vocational skills

[37] Lang and Manove (2011) develop a signalling model which predicts that when expecting statistical discrimination, blacks invest more in education than whites of similar ability, in order to signal their human capital to employers.

which may only be of value in the host country. This might be relevant given that vocational training does not carry the same value in many other countries as it does in Germany. However, it is questionable whether this channel plays a major role for the pupils in my sample, given that these individuals are all born in Germany and many may actually have little attachment to the home country of their parents.

The survey contains a question as to whether a person plans to stay in Germany forever, or whether she may leave Germany at some time in the future. However, this question was only asked to the migrant pupils, and also among those about half of the respondents have missing values. Among the non-missing observations, 15 % of the migrant pupils said they may leave in the future.

Overconfidence. Given the "mismatch" documented above, i.e. the fact that many less skilled pupils plan to work in tertiary occupations which are not viable alternatives for them, one might conjecture that migrants generally tend to overestimate their academic abilities. I make use of a survey question which asks respondents whether they think they learn quickly in German lessons, and compare this subjective assessment with the individual's performance in the reading test. In particular, a pupil is classified as being "overconfident" if she answers "Rather yes" or "Yes" to this question whether she learns German quickly, but reaches a reading test score below the median (with alternative classifications providing very similar results). However, further analyses show no difference in overconfidence between migrants and natives after controlling for background characteristics.[38]

How much can these factors explain the differences in career plans? In Table 3.7, I next analyze the question to what extent the four mechanisms discussed above can account for the gaps in career plans between migrants and natives. Panel A considers as outcome whether the pupil aspires a tertiary occupation. I also use interaction terms of the transmission channels with the migrant dummy (except for the variable "intention to leave" as this question was only asked for the migrants).[39]

Pupils who expect higher labour market returns to tertiary occupations are more likely to aspire such an occupation, although the magnitude is not large: an increase in expected returns by about 10 ppts. leads to an increase in the likelihood to aspire a tertiary occupation by 2.2 ppts. This effect is also identical for natives and migrants. There is the surprising finding that expected discrimination in the vocational training market only has an effect for the natives, but not for the migrants. For example, natives who expect discrimination are more likely to aspire to work in a tertiary occupation (by 2.4 ppts.), but the effect is negative for the migrants (2.4 ppts. - 3.6 ppts.

[38] Results are available upon request. Note that when considering the raw difference, migrants mechanically have a higher probability of being overconfident than natives, simply because they more likely have lower skills.

[39] To save space, results are presented pooled for both genders, but the main results are very similar for boys and girls.

Table 3.7: Possible explanatory factors for migrants' different career plans

	(1)	(2)	(3)	(4)	(5)
A. Dep. var: Pupil aspires a tertiary occupation					
Migrant	0.079***	0.074***	0.089***	0.077***	0.073***
	(0.011)	(0.011)	(0.013)	(0.012)	(0.011)
Expected return to tertiary occ.		0.022***			
		(0.005)			
Migrant × Expected return to tertiary occ.		0.001			
		(0.001)			
Expected discrimination			0.024***		
			(0.008)		
Migrant × Expected discrimination			-0.036*		
			(0.019)		
Overconfidence				0.009	
				(0.013)	
Migrant × Overconfidence				0.025	
				(0.023)	
Migrant × Wants to leave Germany					0.047***
					(0.016)
B. Dep. var: Pupils expects a tertiary occupation					
Migrant	0.045***	0.041***	0.050***	0.046***	0.044***
	(0.009)	(0.010)	(0.011)	(0.011)	(0.009)
Expected return to tertiary occ.		0.014***			
		(0.004)			
Migrant × Expected return to tertiary occ.		0.000			
		(0.000)			
Expected discrimination			0.012		
			(0.007)		
Migrant × Expected discrimination			-0.017		
			(0.018)		
Overconfidence				0.015*	
				(0.009)	
Migrant × Overconfidence				0.007	
				(0.019)	
Migrant × Wants to leave Germany					0.011
					(0.015)
N	10168	10168	10168	10168	10168
Further controls	Yes	Yes	Yes	Yes	Yes

Note: This table shows coefficients from OLS regressions, additionally controlling for parental background, skills, and school fixed effects. Standard errors in parentheses, clustered at the school level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC4, own calculation.

= -1.2 ppts). This is actually the opposite of what one would expect. However, in any case, these results do not support the theory that expected discrimination is a reason for why migrants have more academically oriented career plans. The role of overconfidence is also rather small. The intention to leave Germany in the future is associated with a higher propensity to aspire tertiary occupation. Nevertheless, the explanatory power of this channel is also limited, as there is still a 7.3 ppts. difference (the baseline coefficient of "migrant" in Panel A) between migrant pupils who do not want to leave and natives. Similar results emerge when considering as the outcome whether the pupil expects to work in a tertiary occupation (in Panel B of Table 3.7).

Overall, these findings do not allow to pinpoint the exact reasons for differences in career plans of migrants and natives. I find that while the migrants' higher expected labour market returns to tertiary occupations and their higher intention to leave Germany play some role, the magnitude of both effects are rather small. Moreover, there is no evidence that anticipated discrimination is a major reason for why migrants are more likely to aspire tertiary occupations.[40] Finally, there is no evidence that migrants are more ambitious because they generally overestimate their cognitive skills.

Another reason that has been proposed in the literature are information differences and the migrants' lower familiarity with the institutions of the German education system (Relikowski et al. 2012, Hunkler 2014). In many of the migrant families' home countries, vocational education is considered inferior and academic education is often seen as the only route towards success. This is because many countries lack a German-style apprenticeship system which also offers qualified training for less-skilled pupils. Moreover, information deficits could also lead to the migrant pupils or their parents having less clear information about which occupations are best suited for them given their school level. Information differences are consistent with my findings that migrants are not only more likely to aspire academic occupations, but also more likely to expect to work in these occupations, even among those pupils for whom these high-skilled occupations are out of reach.

3.5.2 Comparing Migrant Subgroups

Tables 3.8a and 3.8b compare migrant youth from the largest nationality groups in Germany, in particular those of Turkish origin, those from Southern Europe (Spain, Portgual, Italy, Greece), former Yugoslavia, the Former Soviet Union (FSU), and Poland.

First consider the characteristics in Table 3.8a. In terms of mathematics and reading skills, youth from Turkish background are behind all other groups, with test scores that are about 0.7-0.9 standard deviations lower than those of native pupils. However, migrants from other guest worker countries and the FSU also have lower scores than natives. In terms of career plans (conditional on

[40] These results are consistent with Tjaden and Hunkler (2017), who also use the NEPS data, albeit a different mode of analysis, as well as Salikutluk (2016). Both studies also find no role for expected discrimination as a driver of migrants' educational aspirations.

Table 3.8a: Comparing different migrant subgroups (characteristics)

	Mathematics test scores		Reading test scores		Aspires to work in tertiary occ.		Expects to work in tertiary occ.	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Gaps relative to natives:								
Turkey	-0.780***	-0.735***	-0.951***	-0.940***	0.103***	0.177***	0.044*	0.076***
	(0.057)	(0.057)	(0.069)	(0.064)	(0.032)	(0.034)	(0.023)	(0.026)
Southern Europe	-0.316***	-0.526***	-0.244**	-0.582***	0.021	-0.048	0.113***	0.009
	(0.094)	(0.077)	(0.107)	(0.116)	(0.046)	(0.042)	(0.045)	(0.033)
Former Yugoslavia	-0.486***	-0.612***	-0.518***	-0.721***	0.060	0.060	0.079*	-0.015
	(0.118)	(0.102)	(0.136)	(0.120)	(0.056)	(0.047)	(0.045)	(0.034)
Former Soviet Union	-0.473***	-0.364***	-0.532***	-0.569***	0.039	0.021	-0.040	-0.013
	(0.127)	(0.088)	(0.106)	(0.085)	(0.053)	(0.044)	(0.033)	(0.033)
Poland	-0.305**	-0.471***	-0.208	-0.434***	0.165***	0.072	0.042	0.001
	(0.146)	(0.098)	(0.133)	(0.106)	(0.057)	(0.046)	(0.052)	(0.044)
Other	-0.222***	-0.288***	-0.211**	-0.284***	0.075**	0.145***	0.066**	0.036
	(0.084)	(0.064)	(0.093)	(0.079)	(0.035)	(0.031)	(0.027)	(0.028)
N	4932	4899	5090	5078	5090	5078	5090	5078

Note: This table shows coefficients from OLS regressions. The regressions for the tertiary share in the aspired/expected occupation additionally control for parental background, skills, and school fixed effects. Standard errors in parentheses, clustered at the school level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC4, own calculation.

Table 3.8b: Comparing different migrant subgroups (transitions)

	Boys			Girls		
	No qualified training	Vocational education	Tertiary education	No qualified training	Vocational education	Tertiary education
A. Unconditional gaps relative to natives:						
Turkey	0.238***	-0.148***	-0.090***	0.101***	-0.038	-0.063*
	(0.031)	(0.030)	(0.023)	(0.033)	(0.036)	(0.033)
Southern Europe	0.064	-0.009	-0.055	0.144***	-0.032	-0.111***
	(0.046)	(0.052)	(0.041)	(0.051)	(0.048)	(0.040)
Former Yugoslavia	0.129**	-0.118**	-0.011	-0.027	0.186***	-0.159***
	(0.061)	(0.060)	(0.054)	(0.052)	(0.054)	(0.037)
Former Soviet Union	0.083	-0.032	-0.051	0.070	-0.007	-0.063*
	(0.055)	(0.057)	(0.043)	(0.047)	(0.045)	(0.036)
Poland	0.145***	-0.201***	0.056	0.056*	-0.074**	0.018
	(0.040)	(0.038)	(0.040)	(0.034)	(0.036)	(0.034)
Other	0.126***	-0.167***	0.041	0.078***	-0.053*	-0.025
	(0.035)	(0.035)	(0.034)	(0.028)	(0.030)	(0.027)
B. Gaps conditional on parental background, skills, and school fixed effects:						
Turkey	0.147***	-0.196***	0.049**	-0.013	-0.064*	0.077***
	(0.037)	(0.037)	(0.020)	(0.038)	(0.034)	(0.023)
Southern Europe	-0.020	0.028	-0.008	0.085	-0.067	-0.018
	(0.047)	(0.046)	(0.032)	(0.053)	(0.048)	(0.035)
Former Yugoslavia	0.048	-0.098*	0.050	-0.112**	0.128**	-0.016
	(0.061)	(0.058)	(0.033)	(0.056)	(0.058)	(0.040)
Former Soviet Union	0.043	-0.097*	0.054**	-0.057	-0.014	0.071***
	(0.059)	(0.057)	(0.024)	(0.051)	(0.050)	(0.027)
Poland	0.003	-0.048	0.045	0.044	-0.001	-0.043
	(0.066)	(0.078)	(0.042)	(0.054)	(0.056)	(0.037)
Other	0.076**	-0.121***	0.046*	-0.012	-0.017	0.029
	(0.037)	(0.032)	(0.027)	(0.035)	(0.032)	(0.027)
C. Gaps conditional on parental background, skills, and school fixed effects, and career plans:						
Turkey	0.100***	-0.115***	0.014	-0.021	-0.004	0.025
	(0.038)	(0.038)	(0.021)	(0.038)	(0.033)	(0.022)
Southern Europe	-0.047	0.052	-0.005	0.082	-0.067	-0.015
	(0.047)	(0.042)	(0.034)	(0.054)	(0.043)	(0.035)
Former Yugoslavia	0.022	-0.017	-0.005	-0.074	0.108**	-0.033
	(0.058)	(0.055)	(0.029)	(0.057)	(0.055)	(0.041)
Former Soviet Union	0.015	-0.043	0.028	-0.008	-0.051	0.059*
	(0.057)	(0.053)	(0.025)	(0.049)	(0.047)	(0.031)
Poland	-0.031	-0.015	0.047	0.032	0.015	-0.047
	(0.058)	(0.062)	(0.035)	(0.051)	(0.052)	(0.037)
Other	0.065*	-0.091***	0.026	-0.017	0.023	-0.006
	(0.037)	(0.033)	(0.027)	(0.035)	(0.029)	(0.025)
N	5090	5090	5090	5078	5078	5078

Note: This table shows coefficients from OLS regressions, and the panels A, B and C are based on specifications with different sets of covariates. The coefficients report the difference between the respective migrant groups compared to native pupils. Standard errors in parentheses, clustered at the school level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC4, own calculation.

background and skills), there are also some differences between the nationalities. Turkish pupils of both genders consistently have much more academic aspirations and expectations than similarly skilled natives. For the other nationality groups, the differences are typically smaller in magnitude. Overall, it is remarkable that the group with the lowest educational performance and the arguably greatest cultural distance to German society (pupils from Turkish origin) at the same time has the most ambitious career plans. This pattern speaks for the presence of information deficits as a possible channel.

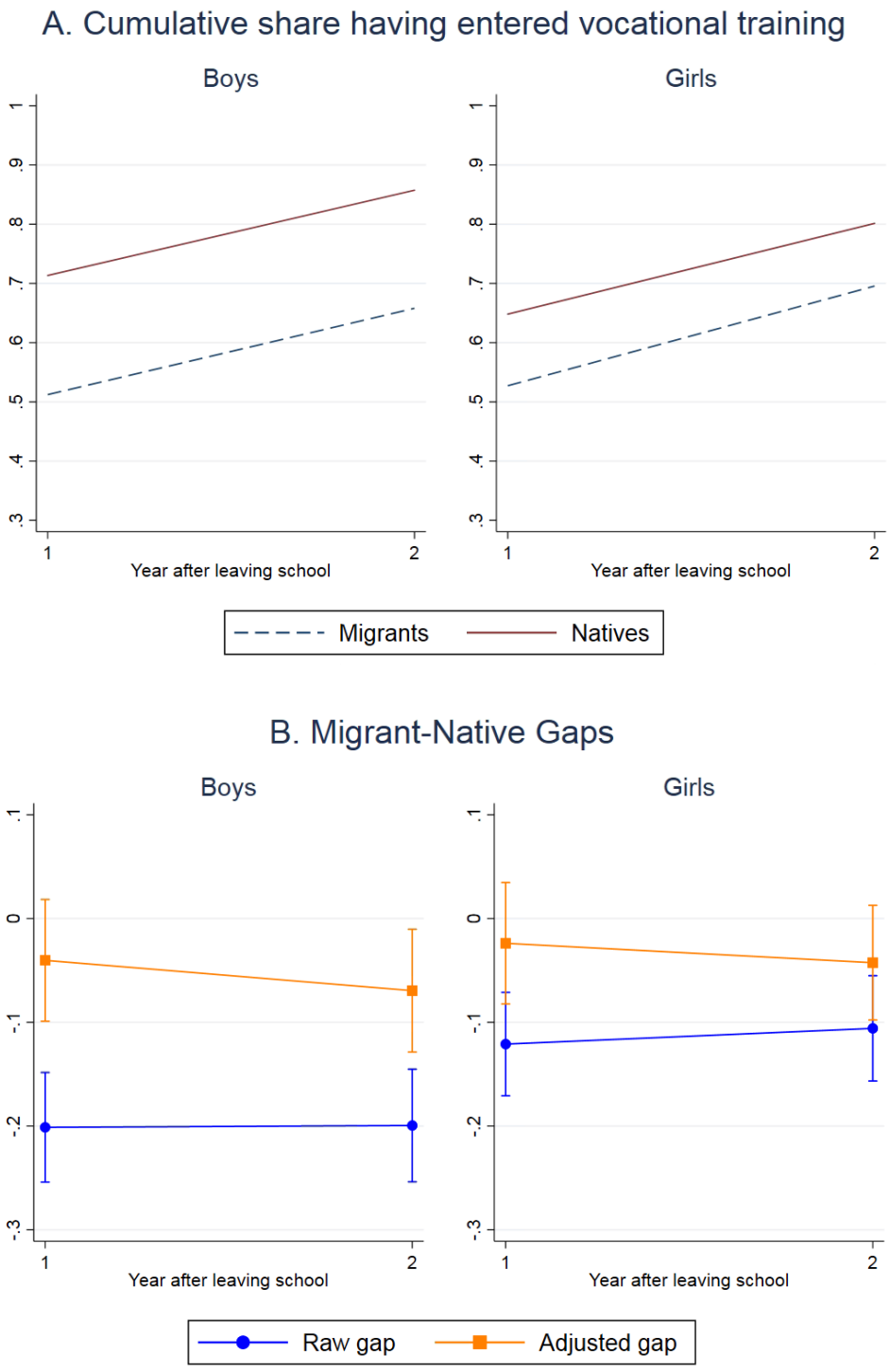
Table 3.8b then compares post-school transitions between different migrant groups. Panel A shows unconditional differences relative to natives. Turkish youth have the highest risk of remaining without qualified training (in the order of 23.8 ppts. for boys and 10.1 ppts. for girls), which is in line with the previous literature (see Hunkler 2014 for a review). As shown in Panel B, the pattern of polarization conditional on background and skills is visible for Turkish, Yugoslavian, FSU and "Other" boys. Turkish and FSU girls have higher transition rates to tertiary education than skills and background would predict. Finally, as shown in Panel C, there also exists a fairly large "unexplained" gap for the "no qualified training" transition for Turkish boys (10 ppts.), but not for Turkish girls.

3.5.3 Cumulative Transition Rates over Time

Especially for less skilled pupils, the school-to-work transition has become increasingly complex since many of them do not move to qualified vocational training immediately after school, but instead enter e.g. pre-vocational programmes which do not award full vocational degrees (Solga 2015). However, it is possible that a school leaver who has not found a vocational training place directly after school can find a place later. For the purpose of this study, a key question also is whether, despite their worse performance directly after school, migrants can catch up relative to natives over time. I address this issue by considering individuals' activities in the second year after leaving school for the subgroup of pupils who leave school without a higher secondary degree.

Figure 3.4a shows the cumulative transition rates, i.e., whether a person has taken up firm-based or school-based vocational education in the first or the second year after school. For both migrants and natives, the share entering vocational education increases considerably over time. For boys, the cumulative share who have entered any vocational education in the second year is 86 % for natives, and 68 % for migrants. For girls, the shares are 80 % for natives, and 70 % for migrants. As shown in Figure 3.4b, the "raw" migrant-native gaps remain fairly constant over time at around -20 ppts. for boys and slightly above -10 ppts. for girls. In other words, while migrants make progress over time, they don't yet catch up relative to natives. There is also some evidence in Figure 3.4b that the "unexplained" gap increases over time. This could mean that factors like school degrees or career plans while in school matter more for the immediate transition in the first year after school, but lose some of their explanatory power as time goes by.

Figure 3.4: Cumulative transition rates into vocational training (school leavers without higher secondary degree)



Note: Panel A shows the cumulative share of migrant and native pupils who have entered vocational training by the first and second year after leaving secondary school. Panel B shows the migrant-native gaps in the cumulative transition rates. "Raw gaps" do not control for further characteristics, while "adjusted gaps" additionally control for parental background, skills, school fixed effects, as well as career plans. 95 % confidence intervals for raw and adjusted gaps are shown, based on standard errors clustered at the school level. Source: NEPS SC4, own calculation.

3.6 Conclusion and Discussion

This paper has used rich German survey data to better understand the gaps in post-schooling transitions between native pupils compared to second and third generation immigrant pupils. I find that standard measures of parental background, human capital before leaving school, or school fixed effects play a role in accounting for the migrant-native gaps, but are not sufficient. The analyses highlight an additional role of career aspirations and expectations. Migrants have more academically oriented career plans than natives of similar parental background and skills. These differences are present throughout the skill distribution, but they have different effects for less skilled and high-skilled pupils. On the one hand, less skilled migrants, who in Germany's tracked school system do not have the option to attend tertiary education, are diverted from more viable alternatives such as vocational training, and have a higher risk of remaining without qualified training than their background and skills would predict. On the other hand, high-skilled migrants are more likely to attend tertiary education than their background would predict.

The finding that their higher ambitions allow high-skilled migrant pupils to "swim upstream" in terms of tertiary attendance may be viewed as a good thing because this may contribute to upward social mobility relative to the parental generation and foster their integration into the labour market and society. However, one caveat is that while migrants have higher rates of tertiary attendance, they might also have higher dropout rates later on if they are less prepared for their studies. This could not yet be analyzed with the present data, but there is evidence that dropout rates from university can be substantial and are also typically higher among minority students.[41] For the less skilled pupils, the paper has shown that higher aspirations can be problematic if these pupils are less prepared for vocational education as a more viable alternative, at least in the short run. While it is in principle possible that later on, the less skilled migrants catch-up to natives (over may even overtake them), the evidence in this paper has shown little evidence for such a catch-up. Moreover, the literature on scarring effects of youth unemployment has shown that inactivity at early stages of the career has negative long-term consequences (see e.g. Schmillen and Umkehrer 2018).

The analyses do not completely rule out discrimination in the vocational training market as a further explanatory factor since there are unexplained gaps for some subgroups such as less skilled boys and boys of Turkish origin. In an observational study like the present one, it is unclear whether this unexplained effect in fact is due to discrimination, or whether it simply reflects some unobserved differences in productivity between migrants or natives. Nevertheless, although discrimination can't be fully ruled out, I find that most of the migrant-native gap can be explained by pupils' parental background, skills, and career plans. I also find no evidence that migrants' different career planning is simply driven by them expecting discrimination in the apprenticeship market.

[41] See e.g. Arcidiacono and Koedel (2014) for a detailed analysis of the higher college dropout rates among African American students compared to White students.

These results thus suggest that any policy that tries to improve migrant youths' transitions should rather focus on improving their skills, or on providing them more extensive measures of career counselling, at least for the less skilled pupils. Previous research has shown that interventions such as providing counselling or information can be effective to help schoolleavers to make better informed choices.[42] It would also be highly relevant to understand whether such interventions can contribute to closing the gaps between native and migrant youth.

[42]For example, Peter and Zambre (2017) have shown that information provision contributes to closing the gap in college enrollment between youth from different parental backgrounds. Goux et al. (2015) find that counselling can help less skilled pupils to formulate more realistic educational aspirations and reduce dropout rates.

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Appendix to Chapter 3

Table 3.A1a: Selected background characteristics (school leavers without higher secondary degree)

	Boys				Girls			
	Migrants	Natives	Diff.		Migrants	Natives	Diff.	
Parental Education:								
Vocational	.445	.804	-.359	***	.493	.812	-.319	***
Tertiary	.042	.1	-.059	***	.038	.067	-.029	**
No postsec.	.513	.096	.417	***	.469	.121	.348	***
Grew up with both parents	.699	.671	.029		.68	.632	.048	*
Number of siblings	1.801	1.376	.425	***	1.967	1.372	.594	***
Secondary school degree:								
No school degree	.051	.033	.019	*	.041	.03	.01	
Lower sec. (basic)	.322	.22	.102	***	.267	.186	.081	***
Lower sec. (advanced)	.194	.157	.037	*	.189	.126	.063	***
Middle sec.	.433	.59	-.158	***	.504	.658	-.154	***
Higher sec. (FHR)	0	0	0	.	0	0	0	.
Higher sec. (Abitur)	0	0	0	.	0	0	0	.
9th Grade Test Scores:								
Reading	-.952	-.511	-.44	***	-.809	-.346	-.463	***
Mathematics	-.623	-.277	-.346	***	-.947	-.669	-.278	***
Reads a lot in his/her spare time	.21	.218	-.007		.387	.451	-.064	**
Plays musical instrument	.231	.209	.022		.247	.275	-.028	
Member of a sports club	.565	.572	-.007		.337	.468	-.132	***
Member of a voluntary service club	.084	.187	-.103	***	.066	.103	-.037	***
Lives in a big city	.31	.164	.146	***	.284	.172	.112	***
University present in district	.306	.195	.111	***	.245	.193	.052	
District with high youth unempl. rate	.371	.399	-.027		.385	.397	-.011	
N	490	2523			514	1936		

Note: The table includes only school leavers who left school without a higher secondary degree. To test whether the migrant-native gap for a certain variable is statistically significant, a bivariate OLS regression is run with standard errors in parentheses clustered at the school level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC4, own calculation.

Table 3.A1b: Selected background characteristics (school leavers with higher secondary degree)

	Boys				Girls			
	Migrants	Natives	Diff.		Migrants	Natives	Diff.	
Parental Education:								
Vocational	.312	.594	-.282	***	.374	.603	-.228	***
Tertiary	.268	.362	-.094	**	.217	.356	-.139	***
No postsec.	.42	.044	.376	***	.409	.041	.368	***
Grew up with both parents	.839	.818	.021		.825	.816	.009	
Number of siblings	1.42	1.269	.15		1.46	1.242	.218	***
Secondary school degree:								
No school degree	0	0	0	.	0	0	0	.
Lower sec. (basic)	0	0	0	.	0	0	0	.
Lower sec. (advanced)	0	0	0	.	0	0	0	.
Middle sec.	0	0	0	.	0	0	0	.
Higher sec. (FHR)	.233	.143	.09	***	.211	.14	.071	***
Higher sec. (Abitur)	.767	.857	-.09	***	.789	.86	-.071	***
9th Grade Test Scores:								
Reading	.003	.473	-.471	***	.244	.666	-.422	***
Mathematics	.413	.889	-.476	***	-.048	.416	-.463	***
Reads a lot in his/her spare time	.335	.373	-.039		.606	.673	-.068	**
Plays musical instrument	.327	.406	-.08	**	.534	.533	.001	
Member of a sports club	.739	.76	-.021		.563	.685	-.122	***
Member of a voluntary service club	.053	.105	-.052	***	.069	.075	-.006	
Lives in a big city	.412	.264	.149	***	.374	.259	.116	***
University present in district	.473	.285	.188	***	.423	.291	.132	***
District with high youth unempl. rate	.518	.415	.104	**	.511	.432	.08	*
N	245	1832			350	2278		

Note: The table includes only school leavers who left school with a higher secondary degree. To test whether the migrant-native gap for a certain variable is statistically significant, a bivariate OLS regression is run with standard errors in parentheses clustered at the school level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC4, own calculation.

Table 3.A2a: Career aspirations and expectations (school leavers without higher sec. degree)

	Boys						Girls					
	Mig-rants	Na-tives	Raw Diff.		Cond. Diff.		Mig-rants	Na-tives	Raw Diff.		Cond. Diff.	
Parental educational aspirations:												
Academic	.276	.112	.164	***	.157	***	.276	.118	.158	***	.172	***
Vocational	.504	.705	-.201	***	-.142	***	.56	.706	-.146	***	-.132	***
None	.22	.183	.037	*	-.015		.163	.176	-.013		-.04	
Pupil's occupational aspirations:												
Tertiary	.306	.245	.062	***	.078	***	.337	.244	.093	***	.116	***
Vocational	.502	.579	-.077	***	-.059	**	.521	.639	-.118	***	-.121	**
None	.192	.176	.016		-.019		.142	.116	.026		.005	
Pupil's occupational expectations:												
Tertiary	.11	.091	.019		.04	**	.078	.066	.012		.028	**
Vocational	.627	.73	-.104	***	-.073	***	.747	.782	-.035	*	-.013	***
None	.263	.179	.085	***	.033		.175	.151	.024		-.014	
Aspires to complete higher sec. degree	.341	.243	.097	***	.123	***	.329	.281	.048	*	.102	***
Expects to complete higher sec. degree	.116	.102	.014		.036	**	.117	.103	.014		.04	**
Plans to apply for voc. training after school	.582	.626	-.044	**	-.031		.586	.618	-.032		-.036	
Done a voluntary internship during school	.133	.204	-.071	***	-.055	***	.128	.179	-.05	***	-.034	***
Has applied for voc. training	.737	.82	-.083	***	-.045	**	.695	.746	-.051	**	-.031	**
Knows someone who gives info on voc. tr.	.514	.667	-.152	***	-.102	***	.669	.748	-.079	***	-.045	***
Knows someone who can help with application	.335	.488	-.153	***	-.067	***	.432	.593	-.161	***	-.06	***
Supply-demand ratio in occ. for which applied (if any)	.909	.923	-.013	***	-.012	**	.899	.908	-.009		-.018	**
N	490	2523					514	1936				

Note: The table includes only school leavers who left school without a higher secondary degree. For each variable, the column entitled "raw difference" shows the mean difference in the respective variable between migrants and natives. The column entitled "conditional difference" shows differences regression-adjusted for parental background, skills, and school fixed effects. To test whether the migrant-native gap for a certain variable is statistically significant, a bivariate OLS regression ("raw difference") or a multivariate OLS regression ("conditional difference") is run with standard errors in parentheses clustered at the school level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC4, own calculation.

Table 3.A2b: Career aspirations and expectations (school leavers with higher sec. degree)

	Boys						Girls					
	Mig-rants	Na-tives	Raw Diff.		Cond. Diff.		Mig-rants	Na-tives	Raw Diff.		Cond. Diff.	
Parental educational aspirations:												
Academic	.755	.612	.143	***	.162	***	.76	.601	.159	***	.211	***
Vocational	.127	.154	-.027		-.063	***	.114	.157	-.043		-.088	***
None	.118	.234	-.116	***	-.1	***	.126	.242	-.116	***	-.123	***
Pupil's occupational aspirations:												
Tertiary	.669	.63	.039		.068	**	.677	.655	.023		.062	**
Vocational	.286	.305	-.019		-.053	*	.28	.291	-.011		-.048	*
None	.045	.065	-.02		-.015		.043	.054	-.011		-.013	
Pupil's occupational expectations:												
Tertiary	.567	.544	.023		.07	**	.46	.497	-.037		.027	**
Vocational	.347	.326	.021		-.03		.443	.39	.053	*	-.013	
None	.082	.129	-.047	**	-.043	**	.097	.113	-.016		-.013	**
Aspires to complete higher sec. degree	.947	.955	-.008		.03	**	.977	.958	.019	**	.039	**
Expects to complete higher sec. degree	.837	.87	-.033		.058	***	.82	.869	-.049	**	.019	***
Plans to apply for voc. training after school	.18	.178	.002		-.046	*	.177	.18	-.003		-.048	*
Done a voluntary internship during school	.057	.079	-.022		-.018		.086	.094	-.009		-.003	
Has applied for voc. training	.311	.343	-.032		-.083	***	.313	.334	-.021		-.082	***
Knows someone who gives info on voc. tr.	.71	.793	-.082	*	-.075	**	.789	.817	-.028		-.006	**
Knows someone who can help with application	.657	.808	-.151	***	-.103	***	.803	.863	-.061	**	-.033	***
Supply-demand ratio in occ. for which applied (if any)	.928	.916	.012		.015		.889	.889	0		-.015	
N	245	1832					350	2278				

Note: The table includes only school leavers who left school with a higher secondary degree. For each variable, the column entitled "raw difference" shows the mean difference in the respective variable between migrants and natives. The column entitled "conditional difference" shows differences regression-adjusted for parental background, skills, and school fixed effects. To test whether the migrant-native gap for a certain variable is statistically significant, a bivariate OLS regression ("raw difference") or a multivariate OLS regression ("conditional difference") is run with standard errors in parentheses clustered at the school level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC4, own calculation.

Table 3.A3: Decomposition of migrant-native gaps in transitions

	School leavers without higher secondary degree				School leavers with higher secondary degree					
	Boys		Girls		Boys			Girls		
	No qualified training	Vocational education	No qualified training	Vocational education	No qualified education	Vocational training	Tertiary education	No qualified education	Vocational training	Tertiary education
Migrants	0.492	0.508	0.477	0.523	0.261	0.147	0.592	0.311	0.200	0.489
Natives	0.287	0.673	0.354	0.646	0.228	0.227	0.545	0.309	0.205	0.487
Difference	0.205***	-0.205***	0.122***	-0.122***	0.034	-0.080***	0.047	0.003	-0.005	0.002
	(0.027)	(0.027)	(0.026)	(0.026)	(0.032)	(0.026)	(0.038)	(0.027)	(0.024)	(0.029)
Explained	0.150***	-0.150***	0.107***	-0.107***	-0.006	-0.010	0.017	0.040*	-0.023	-0.017
	(0.019)	(0.019)	(0.024)	(0.024)	(0.023)	(0.027)	(0.029)	(0.023)	(0.021)	(0.026)
Unexplained	0.055**	-0.055**	0.016	-0.016	0.040	-0.070***	0.030	-0.037	0.018	0.019
	(0.027)	(0.027)	(0.032)	(0.032)	(0.036)	(0.040)	(0.035)	(0.034)	(0.023)	(0.031)
Explained by:										
Parental background	0.010*	-0.010*	0.001	-0.001	0.000	-0.002	0.002	0.005	-0.009	0.003
	(0.006)	(0.006)	(0.007)	(0.007)	(0.008)	(0.006)	(0.007)	(0.009)	(0.007)	(0.008)
Skills	0.068***	-0.068***	0.071***	-0.071***	0.005	0.023*	-0.028*	0.059***	-0.002	-0.057***
	(0.016)	(0.016)	(0.020)	(0.020)	(0.017)	(0.012)	(0.014)	(0.018)	(0.011)	(0.017)
Career plans	0.072***	-0.072***	0.035**	-0.035**	-0.011	-0.031	0.042*	-0.024*	-0.012	0.036**
	(0.012)	(0.012)	(0.014)	(0.014)	(0.014)	(0.022)	(0.021)	(0.014)	(0.018)	(0.018)
N	3013	3013	2450	2450	2077	2077	2077	2628	2628	2628

Note: This table shows results from a Blinder-Oaxaca decomposition, in which the total gap in transition rates between migrants and natives is decomposed into the role of characteristics ("explained") and the role of coefficients ("unexplained"). The coefficients from a pooled model including a migrant dummy are used as reference. Standard errors in parentheses, clustered at the school level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC4, own calculation.

Chapter 4

Postsecondary and Labour Market Outcomes of Vocational vs. General Higher Secondary Pupils

4.1 Introduction

In the debate on how young individuals can best be prepared for their future careers, a central question in many countries relates to the relative benefits of vocational education (i.e. teaching skills in specific occupational fields) vs. academic education (i.e. teaching broader sets of skills).[1] The previous evidence has been mixed. One reason for the absence of a clear consensus is that the choice of the type of education may involve several tradeoffs, with pupils' outcomes being affected along several different dimensions and/or having heterogeneous effects for different pupils. It was found that, after controlling for the typically more negative selection of participants, vocational education during secondary school has either no labour market returns (Malamud and Pop-Eleches 2010 for Romania), or positive returns (Meer 2007, Kreisman and Stange 2017 for the U.S.). There also may be a tradeoff between short-run and long-run returns if providing youth with occupation-specific skills facilitates their entry into the labour market, but provides lower employment and earnings later in life (Hanushek et al. 2016). At the same time, a more practically oriented vocational curriculum may help to reduce dropout rates, especially among low-skilled pupils (see Hall 2012, 2016 for Sweden) and can have value for those pupils who do not intend to go to college (see Altonji 1995, Altonji et al. 2012, Kreisman and Stange 2017 for the U.S.). Moreover, an early focus on specific occupational fields may be optimal for some pupils as it helps them to discover their talents and provide them signals about their ability in these fields (Kreisman and Stange 2017).

[1] See Hanushek et al. (2016), Carneiro et al. (2010), and Ryan (2001) for reviews of the international literature.

The present paper revisits these questions in the context of Germany, by estimating the effects of attending a vocational vs. a general higher secondary (HS) school after 10th grade on the type of education chosen after school, the pupils' state of career planning, as well as labour market outcomes.[2] In the tracked German school system, a degree from a HS school is typically required to attend tertiary education. The traditional route to a HS degree has been via general HS schools (*allgemeinbildende Gymnasien*), which put a stronger focus on academic contents in their curriculum. In recent years, however, there has been a growing importance of vocational HS schools (*berufliche Gymnasien/Fachgymnasien*), which also provide access to tertiary education, but have curricula with a stronger focus on vocational knowledge in specific occupational fields and offer more extensive career guidance. In 2015, vocational HS schools awarded about 15 % of all HS degrees (*Abitur*).

In order to estimate the causal effects of the type of HS school, various identification strategies are used. First, I use a selection-on-observables strategy controlling for extensive pre-treatment characteristics in 9th and 10th grade (such as social background, secondary school type, reading and mathematics test scores, educational and occupational aspirations, or Big 5 personality traits). For two of the outcome variables, the data also allow me to estimate value-added type models by controlling for the lagged outcome in 10th grade. Second, I also estimate the regressions separately for the subsample of pupils who attended middle secondary school until 10th grade, for whom selection into treatment based on observable characteristics is much weaker than in the full sample. Third, I implement an instrumental variable estimation using regional variation in the provision of different types of HS schools, which can be considered plausibly exogenous in the present setting.

The analysis relies on two data sets from the National Educational Panel Study (NEPS). The NEPS Starting Cohort 4 (called "Pupil Cohort" in this paper) allows to assess pupils' educational and occupational plans during school and their activities in the first year after leaving school, while the NEPS Starting Cohort 6 ("Adult Cohort") includes adult individuals and shows their full educational biographies and labour market outcomes at adult age.

The results can be summarized as follows. On average, there are large "raw" differences between both groups in terms of HS graduation and the plan to attend university, but the bulk of these differences is driven by the more negative selection of the vocational HS pupils. After controlling for the large set of background characteristics, there remains no effect on HS graduation, but a small negative effect on the plan to attend universities (in the order of -7 ppts. in the baseline specification), and, in turn, a positive effect on the plan to attend universities of applied sciences or

[2] As the paper focuses on pupils who attend full-time secondary school, it differs from most existing research which focuses on the German apprenticeship system (Ryan 2001; Wolter and Ryan 2011). Apprenticeships are for pupils having left full-time secondary school and involve firm-based training components. Hanushek et al. (2016) perform an extensive analysis on the returns to vocational vs. general education covering several industrialized countries, including Germany, but their definition of vocational education mixes both full-time schooling and firm-based apprenticeship training.

vocational education. With respect to career planning, there is a positive effect on the probability that a pupil knows for sure where to apply for after school. I also find some evidence for effect heterogeneities, with the effects being larger in magnitude for boys and for pupils with below-average skills.

Moreover, there is tentative evidence that the vocational HS pupils face *better* labour market outcomes later in life, after adjusting for selection. While the respondents in the Pupil Cohort are still in school and their actual labour market outcomes are not yet observed, I can use as a proxy the median wage in the future occupation they plan to work in. When considering the "raw" difference, the vocational HS pupils plan to work in occupations that offer lower wages than those occupations planned by the general HS pupils. However, after controlling for selection, the occupational wage effect turns positive (in the order of 4.4 % in the baseline specification). These findings are supported by the Adult Cohort, for which actual labour market outcomes are observed. This data set shows a positive, albeit not statistically significant, effect of attending a vocational HS school on earnings. This total positive earnings effect is the sum of a positive direct effect on the one hand (suggesting that vocational HS schools convey labour-market relevant skills), and on the other hand a negative indirect effect (which works through lower participation in university education), with the former dominating the latter. Moreover, while the returns to vocational HS school are larger for individuals early in life and fade off at later ages, they do not become negative.

The present study contributes to various strands of the literature. First, I extend the previous small literature on vocational HS schools in Germany, by considering a broader range of outcomes (in particular long-term educational and labour market outcomes), and by drawing on a much richer set of control variables to control for selection. The volume edited by Köller et al. (2004) contains analyses for one federal state, Baden-Württemberg. The study by Watermann and Maaz (2004) in that volume finds no differences between the two school types in terms of postsecondary educational plans after controlling for observable characteristics, while Lüdtke and Trautwein (2004) in the same volume find that vocational HS pupils have different occupational interests than general HS pupils. However, given the rather limited set of control variables in the data, it is unclear whether these results represent causal effects of the type of HS school.[3] These studies do not consider long-term postsecondary and labour market outcomes.

Second, I contribute to the literature on the returns to vocational vs. general education during full-time secondary schooling, by studying an institutional setting which has not been considered so far, and by accounting for both short-term and long-term outcomes. Kreisman and Stange (2017) focus on coursework in U.S. high schools and find that while basic vocational courses have no effect on wages, there is a positive wage effect for more advanced vocational coursework. Meer (2007), also for the U.S., uses an instrumental variable estimation and finds that although pupils

[3]These studies draw on a data set called TOSCA. Beside basic controls for parental background, some regressions include controls like Abitur grades or test scores in mathematics and English. The latter variables are, however, measured when the pupil already has chosen her HS school type or finished HS school, and thus are possibly affected by the treatment.

on the vocational high school tracks earn less on average, these differences are driven by selection. Instead, there is evidence for comparative advantage, i.e. general students are best off with general education, while vocational students are best off with vocational education.[4] Malamud and Pop-Eleches (2010) focus on general vs. vocational schooling in Romania and find no earnings differences after adjusting for selection using an RDD design. Hall (2012) uses a reform in Sweden which increased the duration of the vocational higher secondary track by one year and shifted the curriculum more towards academic contents. She finds that this increased school dropout rates, especially among students with below-average grades, and had no effect on university enrollment, but positive effects on earnings. For France, Ichou and Vallet (2011) find that different routes towards the higher secondary degree *baccalauréat* (academic, technological and vocational) are correlated with large differences in transition rates to tertiary education.

A third contribution of the present paper is to analyze how attending a schooling environment with a stronger focus on occupational fields and more intensive career counselling affects the process of how pupils plan their careers. An emerging literature argues that a key function of education is not only to provide skills, but also to allow young individuals to learn about their ability in specific fields. Individuals have only imperfect information on their abilities, and update their information based on newly incoming information such as performance in courses in school or college (Altonji 1993, Arcidiacono 2004, Malamud 2011, Zafar 2011, Stinebrickner and Stinebrickner 2011). Most closely related to the present paper is Kreisman and Stange (2017), who develop a model in which pupils are endowed with academic and vocational ability, but have imperfect knowledge about these two types of ability. Coursework during high school provides signals to pupils and allows them to update their beliefs. In this process, vocational coursework 1) has lower (higher) psychic costs for pupils with higher (lower) vocational ability, and 2) enhances (reduces) productivity in the non-college (college) labour market, and 3) increases (decreases) information about vocational (academic) ability, possibly leading some pupils to forgo college. Together, they argue that the effects are ambiguous and likely heterogeneous across pupils. Moreover, other studies have analyzed the effect of specific career counselling measures during secondary school (often in experimental settings) and shown that some of these measures affect pupils' career planning.[5]

The remains of the paper is structured as follows. Section 4.2 explains institutional details on the German secondary school system and the two types of HS schools studied here. It also develops a number of hypotheses which will then be tested in the empirical analysis. Section 4.3 discusses the data sets and the sample selection criteria. Section 4.4 explains the estimation strategy. Section 4.5 contains the results of the empirical analysis. Section 4.6 concludes.

[4]Further studies which estimate the returns to different high school curricula are surveyed in Altonji et al. (2012).

[5]For Germany, Fitzenberger and Lickleder (2017) study counselling for lower secondary pupils, while Siedler and Saniter (2014) analyze the effects of job information centres on secondary students' later outcomes. Borghans et al. (2015) analyze study counselors at Dutch high schools, and Rodriguez-Planas (2012) analyzes an experiment which provided mentoring to low-performing U.S. high school students.

4.2 Background and Hypotheses

4.2.1 Institutional Background

The paper compares two types of higher secondary (HS) schools: general HS schools (German: *Allgemeinbildende Gymnasien*) and vocational HS schools (*berufliche Gymnasien/ Fachgymnasien*).[6,7] Both HS school types award the final HS degree *Abitur*, which provides access to tertiary education, but also allows pupils to enter vocational training, e.g. via firm-based apprenticeships. The HS degrees from both school types are legally equivalent in the sense that they are counted equally, e.g. when a university requires a certain grade point average for some fields of study. However, the final exams and grading standards can differ between the two school types.[8]

Table 4.1 shows that between 2005 and 2015, the number of *Abitur* graduates from general HS schools increased from 205 337 to 252 838 (by 23 %), while the number of graduates from vocational HS schools increased from 30 655 to 49 662 (by 62 %). The share of *Abitur* degrees awarded by vocational HS schools increased from 11.3 % to 14.5 %.

Table 4.1: Types of higher secondary (HS) schools

	2005	2010	2015
Number of Abitur degrees:			
General HS schools	205 337	239 047	252 838
Vocational HS schools	30 655	43 305	49 662
Other HS schools	34 670	33 871	39 784
Share vocational HS	0.113	0.137	0.145

Note: The table shows the number of higher secondary degrees (Abitur degrees) awarded by general HS schools, vocational HS schools, and other HS schools. Further definitions see text. Source: Statistisches Bundesamt, Fachserie 11, Reihe 1+2.

The curricula of general and vocational HS schools contain the same core subjects (German, mathematics, one foreign language), while vocational HS schools additionally have occupation-specific subjects. For example, in the federal state of Baden-Württemberg, occupation-specific

[6]The federal state of Bavaria is the only state in which *berufliche Gymnasien/ Fachgymnasien* do not exist under this label, but it has a similar institution called *Fachoberschule*, where pupils also can obtain the *Abitur* degree. I thus include these schools as vocational HS schools if a Bavarian pupil reports that the school she attends regularly lasts until 13th grade.

[7]There also exist some other HS schools (such as *Berufsoberschulen/Technische Oberschulen*) that offer the *Abitur* degree as well, but are only for older individuals that have already completed a vocational degree. These schools are not studied in this paper, since the individuals in the Pupil Cohort are still too young too have completed vocational training. Moreover, there exist some vocational schools that only offer the *Fachhochschulreife* degree, which only allows access to universities of applied sciences. These schools are also not studied in this paper.

[8]The exact regulations differ by federal state. In most states, *Abitur* exams are administered centrally at the state level, but there are different central exams for general and vocational HS pupils. In other states, the exams are administered by the schools directly. See also Schwerdt and Wößmann (2017) for a further discussion of exam regulations.

subjects make up around one fourth of the total number of instruction hours.[9] Each vocational HS school has a specific occupational focus, such as economics and business, technical studies, health and social care, or nutritional sciences. However, the pupils are not restricted to this particular occupational field after having obtained their *Abitur* degree. They can apply for the same study majors or vocational training occupations as the general HS pupils.

Moreover, Table 4.2 shows that both school types also differ by which career counselling measures they offer.[10] Vocational HS schools take a more active stance in supporting their students with career planning. In particular, these schools are more likely to cover this issue as part of their school curriculum (61 % vs. 42 %), more likely to organize visits to firms (68 % vs. 48 %), and their teachers are also more likely to talk with the pupils about career plans (73 % vs. 47 %).[11]

Table 4.2: Career counselling offered by schools, as reported by pupils

	Gen. HS schools	Voc. HS schools
Career counselling part of school subject	0.421	0.609
Talks with teacher about career plans	0.470	0.734
School organized visit to university	0.712	0.783
School organized visit to firm	0.484	0.678
School organized visit to information centre	0.739	0.775
School organized job information week	0.631	0.668

Note: The table shows the share of pupils in each school type who report that their school has offered a certain career counselling activity. Source: NEPS SC4, own calculation.

In Germany, pupils are typically sorted into the three tracks of lower, middle and higher secondary school after 4th grade, at age 10.[12] Pupils who graduated from lower secondary school (after 9th grade) or middle secondary school (after 10th grade) can on the one hand leave school and enter vocational training directly (typically at a firm-based apprenticeship). Alternatively, they can continue secondary schooling and "upgrade" to the next higher track, before continuing with postsecondary education later.[13] Pupils who graduated from middle secondary school after 10th grade and continue with schooling can either switch to a general or a vocational HS school. Correspondingly, pupils who have been in a general HS school until 10th grade can either continue at

[9] See `http://www.landesrecht-bw.de/jportal/?quelle=jlink&query=BerGymAbiPrV+BW&psml=bsbawueprod.psml&max=true&aiz=true`.

[10] These numbers are self-reported by pupils and are based on the Starting Cohort 4 of the NEPS. See Section 4.3 for a detailed description of the data.

[11] This may be because teachers at vocational HS schools are typically required to have worked at least some time in a firm and thus have more experience with the labour market outside of school, while teachers at general HS schools typically work as school teachers their whole life.

[12] In the federal states of Lower Saxony and Berlin, tracking takes places after 6th grade.

[13] A recent literature has analyzed this "upgrading" and mobility between different secondary school tracks, see Puhani and Mühlenweg (2010), Dustmann et al. (2017) or Biewen and Tapalaga (2017). These authors suggest that the German education system provides opportunities to correct educational decisions made by early tracking after 4th grade.

the same school, or switch to a vocational HS school.

General HS schools offer all grades starting from 5th grade until the *Abitur*, while vocational HS schools typically only start in 11th grade. Thus, the "treatment" considered in the present paper is the school type attended in 11th grade, and all variables measured up to, and including, 10th grade are "pre-treatment" control variables. As will be shown below, those pupils who attend vocational HS schools after 10th grade are to a larger extent "upgraders" who have attended a middle secondary school until 10th grade. Thus, general and vocational HS pupils on average have very different schooling histories until 10th grade which have to be controlled for in the analysis. Additionally, all estimations will also be carried out on the more homogeneous "upgrader subsample" of pupils who attended middle secondary school until 10th grade, before then switching either to a vocational or a general HS school.

Since the school system is administered at the federal state level in Germany, the distribution of vocational relative to general HS schools is also not equal across states.[14] But there is also ample regional variation within federal states. I will come back to this issue in Section 4.5.4, where the within-state regional variation at the district level in the supply of general vs. vocational HS schools will be used as an instrumental variable.

After graduating from HS school, individuals have various options for their post-school education. On the one hand, they can study at an institution of tertiary education, either at universities (which are more academically oriented), or at tertiary institutions which are more practically oriented such as universities of applied sciences (*Fachhochschulen*). For graduates who do not enter tertiary education, an alternative option is vocational education, mostly in the form of a firm-based apprenticeship.[15]

4.2.2 Hypotheses

Having stated the institutional background, it remains to be elaborated which effects of attending a vocational vs. a general HS school on pupils' educational outcomes can be expected. With respect to HS graduation, some previous papers have suggested that more practically oriented vocational coursework may reduce school dropout, in particular for low-skilled pupils (see e.g. Hall 2012 for corresponding evidence from Sweden). At the same time, with respect to the type of post-schooling education, the more academic and theoretical curricula of general HS schools might prepare pupils better for taking up tertiary education, while the more practical curricula in vocational HS schools, which include lessons in specific occupational fields, better prepare pupils for taking up vocational training (Watermann and Maaz 2004). However, it should be noted that

[14]The South-Western state of Baden-Württemberg traditionally has the highest share of vocational HS pupils, with almost 34 % of all *Abitur* degrees in 2012 being awarded at vocational HS schools. See Brauckmann and Neumann (2004) for a historical overview.

[15]Spangenberg and Quast (2016) show that among higher secondary pupils graduating with *Abitur* in 2010, about two thirds attend tertiary education within 15 months after school, and 21 % attend vocational education.

despite the different specializations, the curricula of both school types also show some overlap, especially in the core subjects German, mathematics, and one foreign language (see the discussion in Section 4.2.1, as well as Brauckmann and Neumann 2004). Thus, it remains an empirical question whether the differences are large enough to have any meaningful effect.

An interesting question also is whether vocational HS schools have an impact on pupils' career planning. Educational and occupational decisions for the time after leaving secondary school are complex, since school leavers have to choose between a large number of possible alternatives and possess only imperfect information on their individual talents.[16] Vocational HS schools may reduce the complexity of this decision problem by providing detailed insight into specific occupational fields, and may also "channel" their pupils into specific study majors or occupations (Watermann and Maaz 2004). Lüdtke and Trautwein (2004) report large differences in terms of occupational interests between general and vocational HS pupils, although they also acknowledge that this could be partly be driven by self-selection. How well pupils are prepared for their post-school decisions also hinges upon the question what the different schools offer with respect to career counselling beyond the usual classroom training. Table 4.2 above has shown that vocational HS schools offer much more intensive career counselling activities than general HS schools. Trautwein and Lüdtke (2004) measure pupils' subjective evaluations on how well their schools have prepared them for the decision on postsecondary education. On average, vocational HS pupils report that they feel better prepared for this decision.

Concerning labour market outcomes, the type of HS school could have various, possibly opposing, effects. First, there can be direct effects of the school type in the sense that the skills provided by the schools can be valued differentially in the labour market. Second, there might be indirect effects if the school types differently provide access to further educational or occupational paths. Vocational HS pupils could earn less if they are less likely to participate in tertiary education, and if tertiary education has a positive return on the labour market. However, the extent of these differences is by no means clear if the alternatives to tertiary education are careers in the apprenticeship system which often promise high-paying careers as well.[17] Third, the type of HS school (which is typically stated in an applicant's CV) might convey signals to the employer about the graduates' unobserved productivity. On the one hand, having graduated from a vocational HS school might be a signal for negative academic ability, but it could as well be a positive signal that the pupil has already acquired specialized occupational knowledge from early on that other pupils do not have at that age. Overall, the effect of the type of HS school on labour market outcomes is theoretically ambiguous.

[16] See Fitzenberger et al. (2015) for a literature survey for Germany. The U.S. literature includes, among others, Altonji (1993), Arcidiacono (2004), Malamud (2011), Zafar (2011), Stinebrickner and Stinebrickner (2011), and Kreisman and Stange (2017).

[17] Flake et al. (2016) show that persons who completed an apprenticeship with an additional degree of master craftsman (*Meister*, *Techniker*) earn lower wages than tertiary graduates, but there is also substantial overlap between the wage distribution. About one third of master craftsmen earn more than the average tertiary graduate.

4.3 Data

The empirical analysis draws on two data sets from the National Educational Panel Study (NEPS): the NEPS Starting Cohort 4 (which is referred to as "Pupil Cohort" in this paper), and the NEPS Starting Cohort 6 ("Adult Cohort"). See also Blossfeld et al. (2011) for a general overview of the different data sets associated with the NEPS.

Pupil Cohort. The NEPS Pupil Cohort (Starting Cohort 4) includes a sample of pupils who attended secondary school in 9th grade during the school year 2010/11 and are surveyed again in regular intervals. For the purpose of this paper, I select 4796 pupils who attended either a general or a vocational HS school after 10th grade. This means that pupils are dropped who have already left the schooling system (e.g. to start an apprenticeship), as well as pupils in other school types.[18] Moreover, panel attrition reduces the sample size to 4105 individuals who are still observable in the data one year before expected HS graduation, and 3458 individuals who are observable in the fall after expected HS graduation.[19] The final analysis samples for the regressions are slightly larger (4114 and 3512, respectively), since I can impute the outcome variables for students who are no longer in the sample, but reported having dropped out of school in the previous survey wave.[20] Throughout this paper, the treatment is always defined as whether a person *attended* a general or vocational HS school after 10th grade. If the pupil has dropped out of school by the time the outcome is measured, she still would be classified according to this initial definition. As the dropout decision is potentially endogenous, conditioning on a pupil still being in school at a later grade might lead to biased results.

One outcome is whether the pupil has graduated with the HS degree in the fall after expected graduation.[21] While I can also observe whether a pupil attends university at this time, this is an imperfect measure for "long-term" educational attainment, since a large share of pupils does a gap year (e.g. traveling abroad or working in a social service year) directly after school and postpones further education by at least one year (see Spangenberg and Quast 2016 for evidence). Thus, my preferred specification uses the plans to attend university one year before expected graduation as the outcome. The advantage of this variable is that the survey explicitly asks pupils to exclude gap years when stating their plans after school, i.e., these plans refer to the plans *after* a possible gap year.

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[18] The latter exclusion criterion applies to pupils in comprehensive schools (*Gesamtschulen*) or reform-pedagogic Waldorf schools. It also excludes pupils in those vocational school types that only offer a *Fachhochschulreife* degree, since this degree only allows students to study at universities of applied sciences.

[19] Attrition rates are very similar for both groups. In the year before expected graduation, 88 % (86 %) of the vocational (general) HS pupils are still in the sample. In the fall after expected graduation, 73 % (73 %) of the vocational (general) HS pupils are still in the sample.

[20] Specifically, HS graduation and the plan to attend university are set to zero for school dropouts.

[21] More precisely, this measures graduation "on time". If a pupil had to repeat the class and is one year late, she will not be counted as having graduated.

Moreover, other outcome variables describe the pupil's state of career planning one year before expected graduation. The first outcome is an indicator whether a pupil agrees to the statement: "I already know for certain to which university or to which firm I will apply after school." Moreover, pupils are asked in which occupation they will likely work in the future. Based on this information, I first construct as an outcome variable whether the pupil reports any planned occupation at all. To characterize the planned occupation more closely, I also consider the occupation's median wage, which is obtained from merged administrative data.[22] This variable will be used as a proxy for long-run labour market outcomes which are yet unobserved for the young persons in the Pupil Cohort.[23]

As discussed in more detail below, the Pupil Cohort offers unusually rich control variables. Besides standard social background characteristics, this includes 9th and 10th grade information on cognitive test scores, personality measures as well as educational expectations and aspirations.

Adult Cohort. The NEPS Adult Cohort contains about 17.000 individuals from the birth cohorts 1944 to 1986 who were surveyed in seven waves between 2009 and 2016. Individuals were retrospectively asked about their complete educational biographies, and in each wave were also surveyed about their current employment status and earnings.[24] For the purpose of this study, I restrict the sample to persons who attended a vocational or a general HS school.[25] Since the school system in former communist East Germany was not comparable to that in West Germany, I keep only those who attended school in West Germany. I also restrict the sample to birth cohorts from 1955 onwards. The final sample size for the educational outcome regressions is 1377 individuals.

In the Adult Cohort, the educational outcome variables are whether an individual has graduated from HS school, and whether she attended a particular type of post-school education by the age of 28, distinguishing between the four categories university, university of applied sciences, vocational education, and no further education. Labour market outcomes are measured at the time of the survey, and I construct a person $\times$ year panel pooling the different available survey years. An employment indicator is equal to one if a person was employed for at least 15 hours per week.

[22]Specifically, the wage information comes from a data set provided by Hausmann et al. (2015) which records the median daily wage for full-time employees in each occupation based on German administrative data (the Sample of Integrated Employment Biographies, SIAB). The wage information is merged to the NEPS data at the 3-digit level of the occupational classification used by the German Statistical Office. Moreover, I also use gender-specific wages.

[23]There is the issue that the wage variable is missing for pupils who don't know their planned occupation. However, the findings in Section 4.5.2 below show that vocational and general HS pupils are equally likely to know their planned occupation, which mitigates concerns about sample selection bias.

[24]The NEPS Adult Cohort is a follow-up to the data set *Working and Learning in a Changing World (ALWA)* collected by the Institute for Employment Research (IAB). In particular, about half of the NEPS sample is from the predecessor ALWA study, while the other half has been sampled anew. Unfortunately, those individuals who participated in the ALWA study have to be dropped, since this survey did not ask individuals about the type of HS school they attended.

[25]There are a few individuals who attend HS school after having completed an apprenticeship training first. I drop these late attendees, first because they are probably not comparable to younger attendees; and second, because the individuals in the Pupil Cohorts can't be observed yet when they have finished vocational training.

The other outcome variable is an individual's monthly gross labour earnings.[26] Among the 1377 individuals in the target sample, there are 1312 who were employed at least once. Among these working individuals, there are 1144 with at least one non-missing earnings information, generating a panel with 3874 person $\times$ survey year observations for the earnings regressions.

4.4 Estimation Strategy

The baseline specifications include OLS regressions of the form

$$y_i = \alpha + \beta \cdot VocHS_i + X_i\gamma + u_i$$

where the treatment variable of interest, $VocHS_i$, is an indicator equal to one if the person attended a vocational HS school after 10th grade and equal to 0 if she attended a general HS school. This regression estimates the unbiased effect of $VocHS_i$ under the selection-on-observables assumption $E(u_i|VocHS_i, X_i) = 0$, i.e. that conditional on the observed characteristics X_i, there are no further variables that jointly determine selection into HS school type and the outcome.

I argue that the vector of control variables is extensive enough to justify such an assumption (see also Section 4.5.1. and Table 4.3 below for a detailed description of these variables). In both data sets, there is information on demographic background such as gender, migration background, or parental education and occupation. I also control for the type of secondary school attended until 10th grade, which (as argued in Section 4.2) is an important predictor for the type of HS school attended afterwards. The Pupil Cohort additionally provides extensive "pre-treatment" information on the pupils measured in 9th and 10th grade. As proxies for cognitive ability, there are 9th grade test scores in reading, mathematics and information and communication technology (ICT). Further controls are individuals' educational and occupational aspirations in 9th and 10th grade, in particular whether the pupils plans to complete the *Abitur* degree in the future and whether she think the degree is realistic for her. They also report the occupation they want to work in later. Moreover, the controls include the Big Five personality measures in 9th grade.[27] The data also include information measured in 9th grade on the pupils' leisure activities, such as whether the person reads a lot in her spare time or whether she plays a musical instrument. Finally, regional control variables include federal state dummies, as well as indicators for whether the school is in a city, whether a university or a university of applied sciences is present in the district, and whether the district has a youth unemployment rate above the median.

[26] In case of multiple earnings observations per survey year, I only consider the one with the highest value. I drop earnings observations for persons who are still in vocational or tertiary education, and I also drop earnings below the 1st and above the 99th percentile.

[27] These measures are often found to be important predictors for educational choices (see the review in Almlund et al. 2011). The "Big Five" measures are openness, agreeableness, conscientiousness, extraversion and neuroticism. Each is measured on a 5-point Lickert scale in the data.

Moreover, there is the advantage that the pupils' planned occupation is already measured in 10th grade. Thus, for two of the outcome variables (whether the person has a planned occupation and the median wages of the planned occupation), I am able to condition on the lagged outcome and thus control for time-constant selection bias. The estimations for these two outcomes will thus amount to a "value-added" type regression of the form

$$y_i = \alpha + \rho \cdot y_{i,-1} + \beta \cdot VocHS_i + X_i\gamma + u_i$$

I also use two additional strategies to check the robustness of the estimates. First, I will carry out all estimations separately for the "upgrader subsample", i.e. those pupils that attended middle secondary school until 10th grade, before then upgrading either to a general or a vocational HS school. As will be shown in Section 4.5.1 below, vocational and general HS pupils are much more comparable in terms of social background and cognitive test scores among the upgraders than among the full sample (with the latter also including pupils who have already have attended HS school from 5th grade onwards). It is reasonable that among this more homogeneous subsample, selection based on unobservable characteristics is less strong than in the full sample. This approach follows Altonji et al. (2005) who estimate the effect of attending a Catholic vs. a non-Catholic high school in the U.S. and mostly focus only on those pupils that had already attended a Catholic school in 8th grade. Such a strategy will strengthen the internal validity of the estimates, yet at the expense of external validity because the findings are then only informative about the effects of HS school type for upgraders. Second, Section 4.5.4 below will shows results of an instrumental variables strategy using the regional availability of vocational HS schools as an instrument.

4.5 Results

4.5.1 Descriptive Statistics

Table 4.3 compares the observable characteristics of vocational and general HS pupils in the Pupil Cohort, in order to assess the factors that determine the selection into the two groups. 13 % of the vocational HS pupils have a mother who attended university, compared to 20 % of the general HS pupils. Parents of pupils in vocational HS schools are also less ambitious for their children to attend university later, but they also care more for the school grades of their children.[28] The differences in terms of parental education are also confirmed by the Adult Cohort (see Appendix Table 4.A1).

The Pupil Cohort also shows large differences between the two groups in terms of 9th grade cognitive skills, in the order of about 0.42 standard deviations for reading test scores and 0.58

[28]The latter variable is a somewhat mixed signal. On the one hand, if the parents care a lot about school grades, this could indicate a high level of parental educational investments. On the other hand, this could also be a signal that the pupil is weak in school and needs a lot of support from his parents.

Table 4.3: Descriptive Statistics (Pupil Cohort)

	Full sample				Upgrader subsample			
	Vocational HS pupils	General HS pupils	Diff.		Vocational HS pupils	General HS pupils	Diff.	
Social Background Characteristics:								
Female	.528	.565	-.038		.519	.647	-.128	***
Migration background	.097	.1	-.003		.1	.16	-.06	*
Mother's education:								
Lower sec.	.172	.101	.071	***	.199	.165	.034	
Middle sec.	.509	.38	.128	***	.511	.452	.059	
Higher sec.	.187	.317	-.13	***	.175	.262	-.087	*
Tertiary	.132	.201	-.069	***	.115	.121	-.006	
Father's education:								
Lower sec.	.244	.157	.086	***	.264	.214	.05	
Middle sec.	.362	.286	.075	***	.374	.402	-.028	
Higher sec.	.202	.287	-.085	***	.173	.243	-.07	*
Tertiary	.193	.269	-.076	***	.189	.141	.048	
Mother's occupation:								
Low-skilled	.18	.151	.029		.192	.167	.025	
Medium-skilled	.548	.511	.037		.54	.519	.022	
High-skilled	.062	.128	-.066	***	.05	.036	.014	
Not employed	.21	.21	0	.217	.278	-.061		
Father's occupation:								
Low-skilled	.188	.12	.068	***	.211	.232	-.02	
Medium-skilled	.571	.494	.076	***	.551	.506	.045	
High-skilled	.195	.332	-.137	***	.196	.191	.004	
Not employed	.047	.054	-.007		.042	.071	-.029	
Grew up with both parents	.773	.818	-.046	**		.773	0	
Parents care about school grades	.579	.397	.182	***	.607	.59	.018	
Parents want me to attend university	.48	.754	-.273	***	.458	.528	-.07	*
9th/10th Grade Characteristics:								
Attended HS school in 10th grade	.188	.933	-.745	***	0	0	0	n/a

9th Grade Test Scores:								
Reading score	.258	.677	-.419	***	.273	.256	.018	
Mathematics score	.21	.792	-.582	***	.183	.132	.051	
ICT score	.249	.713	-.464	***	.25	.257	-.007	
Reads a lot in his/her spare time	.5	.572	-.072	***	.51	.507	.003	
Attends cultural activities	.369	.507	-.138	***	.363	.361	.002	
9th grade: Wants to complete Abitur	.82	.982	-.162	***	.793	.838	-.045	
10th grade: Wants to complete Abitur	.821	.984	-.163	***	.808	.925	-.117	***
9th grade: Thinks Abitur is realistic	.406	.86	-.454	***	.365	.509	-.144	***
10th grade: Thinks Abitur is realistic	.538	.909	-.371	***	.516	.669	-.153	***
Big 5 Personality Traits:								
Extraversion	3.377	3.446	-.069	*	3.334	3.432	-.099	
Agreeableness	3.483	3.438	.045		3.493	3.441	.052	
Conscientiousness	3.23	3.123	.107	*	3.289	3.409	-.12	*
Neurocitism	2.762	2.758	.003		2.749	2.846	-.098	
Openness	3.51	3.574	-.064		3.533	3.613	-.08	
10th Grade Planned Occupation:								
Military, Agriculture	.01	.01	0		.012	.004	.008	
Production, Construction	.09	.072	.017		.097	.087	.01	
Natural Sciences, IT	.035	.057	-.022	**	.039	.064	-.025	
Transport, Logistics, Security	.044	.035	.009		.047	.051	-.004	
Commercial Services	.031	.024	.007		*	.018	.011	
Management, Law, Admin.	.113	.083	.03	**	.116	.071	.045	*
Health, Social Serv, Education	.192	.188	.005		.199	.202	-.003	
Media, Culture, Literature	.045	.06	-.015		.038	.073	-.035	*
No planned occ.	.44	.471	-.031			.43	-.007	
Median daily wage of planned occ.	116.2	127.3	-11.1	***	115.6	119.3	-3.7	
Regional Characteristics:								
Federal state	not shown							
City district	.109	.31	-.201	***	.095	.167	-.072	
Tertiary institution present in district	.418	.526	-.108	*	.41	.36	.05	
University present in district	.172	.325	-.154	***	.178	.202	-.024	
Youth unemployment rate above median	.278	.441	-.163	***	.26	.461	-.201	***

Outcome Variables:								
HS graduation	.687	.861	-.174	***	.679	.668	.011	
Plans to attend university	.318	.563	-.246	***	.313	.429	-.115	***
Knows where to apply after school	.284	.197	.086	***	.292	.225	.067	*
Has a planned occupation	.659	.641	.018		.674	.667	.007	
Median daily wage of planned occ,	118.3	122.4	-4.1	*	118.8	115.8	3.0	
N	469	3645			380	231		

Note: To test whether the vocational-general difference for a certain variable is statistically significant, a bivariate OLS regression is run with standard errors in parentheses clustered at the school level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: NEPS SC4, own calculation.

standard deviations for mathematics test scores.[29] Vocational HS pupils also were less likely to state in 10th grade that they want to complete the HS degree, and, in particular, they were less likely to state in 10th grade that the *Abitur* is a realistic endeavour for them.[30] In contrast to cognitive skills and educational aspirations, Big Five personality traits are more balanced across the two groups.

A pronounced difference between both groups is the previous schooling history until 10th grade. Among those pupils who attend a vocational HS school after 10th grade, only about 19 % already attended a HS school in 10th grade, while the rest are "upgraders" that have visited other school types before. Among those pupils who attend a general HS school after 10th grade, the vast majority of 93 % already attended HS school in 10th grade. This lends support to the strategy (outlined in Section 4.4 above) of performing all estimations separately for the "upgrader subsample", i.e. those pupils who attended middle secondary school until 10th grade, before then switching either to a general or vocational higher secondary school. Table 4.3 confirms that among the "upgrader subsample", vocational and general HS pupils are more comparable in terms of observable characteristics in 9th and 10th grade. For example, test scores are even completely balanced across the two groups.

Descriptive statistics of the outcome variables are shown at the bottom of Table 4.3. However, given the more negative selection of vocational HS pupils documented before, it is clear that these descriptive outcome differences can't be interpreted in a causal manner. In the Pupil Cohort, the vocational HS pupils are less likely to have graduated with the HS degree "on time" (in the full sample, 69 % vs. 86 %), less likely to plan to attend university after school (32 % vs. 56 %), and more likely to plan to attend universities of applied sciences or vocational education. At the same time, the vocational HS pupils are more certain about where to apply after school. They also aim for occupations which have slightly lower wages than those occupations planned by the general HS pupils. As expected, the descriptive outcome differences are smaller in magnitude among the "upgrader subsample" than among the full sample. Finally, the results from the Adult Cohort (Appendix Table 4.A1) show that vocational and general HS pupils differ in their education they have attended after school by age 28, and the former also have slightly lower labour earnings as adults.

4.5.2 Effects on Educational and Career Planning Outcomes

Table 4.4 presents the estimation results for the key outcome variables in the Pupil Cohort, showing how the effect of attending a vocational HS school changes when different sets of covariates

[29]To facilitate interpretation, the test scores are normalized with mean zero and standard deviation one within the sample of *all* NEPS pupils, i.e. also including lower and middle secondary pupils. Since the analysis sample includes only higher secondary pupils, the mean score in the analysis sample is above zero.

[30]However, a substantial share of vocational HS pupils has made progress between the 9th grade and 10th grade: the share of pupils who think the *Abitur* is realistic increased from 41 % to 54 %.

are controlled for. For the outcome whether a pupil has successfully graduated with the HS degree, there is a negative "raw" effect of -17.4 ppts., which becomes smaller in magnitude when controlling for social background characteristics (-14.8 ppts.) and becomes basically zero (+1.5 ppts.) when additionally controlling for 9th and 10th grade variables (such as test scores, educational aspirations/expectations, and personality traits). For the outcome whether a pupil plans to attend university, a similar pattern can be observed, with a "raw" gap of -24.6 ppts. declining to -7.3 ppts. when controlling for all characteristics. These results demonstrate that for these two outcomes, most of the raw difference is driven by the more negative selection of the vocational HS pupils.

In the "upgrader" sample, the "raw" effects are smaller in magnitude than in the full sample and the treatment effect changes less strongly when the control variables are included. This is to be expected given that selection on variables such as parental background or test scores is less strong in the upgrader subsample (see Section 4.5.1. above). The conditional effects of attending a vocational HS school, however, are similar in magnitude when considering the outcomes HS graduation (+3.3 ppts.) and planned university attendance (-7.3 ppts.).

Turning to the other outcome variables, Table 4.4 also shows that attending a vocational HS school significantly increases the probability that a pupil knows for sure at which tertiary institution or firm she will apply after school. The effect size of +6.8 ppts. is sizeable, compared to a baseline probability of 19.7 % in the control group of general HS pupils. Interestingly, the effect is also more stable across the different specifications and samples than for the other outcomes. There is no effect on the probability that a pupil knows in which occupation she will likely work in the future. There are, however, interesting effects when considering the wage of the planned occupation as a proxy for future labour market outcomes. The negative "raw" difference of -5.2 % is completely driven by selection, and turns positive to a statistically significant +4.4 % once characteristics are controlled for. The results are again fairly similar for the upgrader sample.

Overall, these results suggest that attending a vocational HS school improves career planning as that pupils feel better informed about their next steps after finishing school and that attending a vocational HS school changes occupational plans in a way that pushes pupils into better paid occupations.

4.5.3 Heterogeneity

Effect Heterogeneity by Observable Characteristics. Table 4.5 shows the results when stratifying the sample by gender and cognitive skill (whether a pupil had a 9th grade reading score below or above the mean). There is indeed evidence for heterogeneous treatment effects, although the sample sizes are often too small to allow definitive conclusions. For example, while there seems to be a positive effect of attending a vocational HS school on HS graduation for men and for low-skilled pupils, neither of these effects is statistically significant.[31] The negative effect of attending

[31] Hall (2012) provides evidence that a Swedish reform including a shift towards a more general (and less vocational) curriculum has increased dropout rates among low-skilled pupils.

Table 4.4: Effects of attending a vocational HS school on educational and career planning outcomes

	Full sample				Upgrader subsample			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Outcome: Higher secondary graduation								
Voc. HS	-0.174***	-0.148***	-0.155***	0.015	0.011	0.007	-0.012	0.033
	(0.026)	(0.025)	(0.025)	(0.035)	(0.046)	(0.045)	(0.050)	(0.054)
N	3512	3512	3512	3512	539	539	539	539
Outcome: Plans to attend university								
Voc. HS	-0.246***	-0.178***	-0.167***	-0.073**	-0.115***	-0.117***	-0.094**	-0.073
	(0.025)	(0.026)	(0.026)	(0.032)	(0.040)	(0.039)	(0.043)	(0.046)
N	4114	4114	4114	4114	611	611	611	611
Outcome: Knows where to apply after school								
Voc. HS	0.086***	0.062**	0.065***	0.068**	0.067*	0.060	0.076*	0.085*
	(0.023)	(0.024)	(0.025)	(0.033)	(0.037)	(0.038)	(0.043)	(0.046)
N	4114	4114	4114	4114	611	611	611	611
Outcome: Has a planned occupation								
Voc. HS	0.018	0.018	0.031	0.018	0.007	0.014	0.045	0.030
	(0.026)	(0.026)	(0.026)	(0.035)	(0.039)	(0.040)	(0.044)	(0.046)
N	4114	4114	4114	4114	611	611	611	611
Outcome: Log median wage of planned occupation								
Voc. HS	-0.052**	-0.012	-0.011	0.044**	0.060*	0.038	0.028	0.053*
	(0.022)	(0.018)	(0.018)	(0.022)	(0.035)	(0.028)	(0.028)	(0.029)
N	2612	2612	2612	2612	398	398	398	398
Control variables:								
Social background variables		Yes	Yes	Yes		Yes	Yes	Yes
Regional variables			Yes	Yes			Yes	Yes
9th/10th grade variables				Yes				Yes

Note: This table shows coefficients from OLS regressions. See Table 4.3 for full list of control variables. Standard errors in parentheses, clustered at the school level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC4, own calculation.

Table 4.5: Effect heterogeneity – by observable characteristics

	Outcome variable:				
	Higher sec. graduation	Plans to attend university	Knows where to apply	Knows planned occupation	Log median wage in planned occ.
	(1)	(2)	(3)	(4)	(5)
Males					
Voc. HS	0.084	-0.099*	0.050	-0.005	0.049
	(0.052)	(0.051)	(0.049)	(0.057)	(0.037)
N	1591	1784	1784	1784	1126
Females					
Voc. HS	-0.027	-0.056	0.080*	0.042	0.037
	(0.047)	(0.045)	(0.046)	(0.042)	(0.027)
N	1921	2330	2330	2330	1486
Pupils with below-average reading skills					
Voc. HS	0.047	-0.090**	0.090**	0.008	0.039
	(0.044)	(0.041)	(0.042)	(0.044)	(0.029)
N	1637	1906	1906	1906	1170
Pupils with above-average reading skills					
Voc. HS	-0.026	-0.071	0.051	0.053	0.044
	(0.055)	(0.062)	(0.055)	(0.059)	(0.035)
N	1712	2017	2017	2017	1320
Further controls	Yes	Yes	Yes	Yes	Yes

Note: This table shows coefficients from OLS regressions. All control variables in Table 4.3 are included. Standard errors in parentheses, clustered at the school level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC4, own calculation.

a vocational HS school on the plan to attend university is stronger for men. Further analyses (not shown here) also reveal that for men there is also a strong positive effect on the plan to attend a university of applied sciences. It seems reasonable that men react more strongly along this margin, because universities of applied sciences with their focus on science or technical subjects are generally more popular among men. Moreover, the negative effect of vocational HS schools on the plan to attend university and the positive effect on knowing where to apply for after school are much stronger for pupils with below-average reading skills. It is conceivable that for those weaker students, the school environment generally has a larger impact.

Table 4.6: Effect heterogeneity – by type of vocational HS school

	Outcome variable:				
	Higher sec. graduation	Plans to attend university	Knows where to apply	Knows planned occupation	Log median wage in planned occ.
	(1)	(2)	(3)	(4)	(5)
Reference: General HS					
Vocational HS: Business	0.029	-0.076*	0.045	0.032	0.040
	(0.044)	(0.045)	(0.041)	(0.046)	(0.030)
Vocational HS: Technical	0.009	-0.080	0.134**	0.014	0.068*
	(0.060)	(0.052)	(0.064)	(0.072)	(0.041)
Vocational HS: Other	0.006	-0.070*	0.062	0.007	0.039
	(0.043)	(0.039)	(0.039)	(0.041)	(0.025)
Further controls	Yes	Yes	Yes	Yes	Yes
N	3512	4114	4114	4114	2612

Note: This table shows coefficients from OLS regressions. All control variables in Table 4.3 are included. Standard errors in parentheses, clustered at the school level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC4, own calculation.

Effect Heterogeneity by Type of Vocational HS School. Table 4.6 shows heterogeneous effects by the occupational field of the vocational HS school, distinguishing between schools with a specialization in business, technology, and a category "Others".[32] Again, the regressions control for the type of occupation a pupil plans in 10th grade (see Table 4.3), and thus control for the selection effect that e.g. pupils with a stronger interest in technical occupations self-select into vocational HS schools with a technical focus. All effects in these regressions are to be interpreted in reference to the group of general HS schools. The zero effect on HS graduation and the negative effect on planned university attendance are present among all types of vocational HS schools. The positive effects on career planning and aiming for a better paid occupation seem to be strongest for the vocational HS schools with a technical focus.

4.5.4 Instrumental Variables Estimation

The previous analyses have relied on a selection-on-observables assumption. However, it is still possible that vocational and general HS pupils differ in some unobserved characteristics that simultaneously affect the outcomes. To assess whether the previous results are sensitive to such selection on unobservables, I use an instrumental variables approach using as instrument the regional share of HS degrees that were obtained in vocational (relative to general) HS schools.[33]

[32]The latter category subsumes a number of different vocational HS school types for which there are too few observations in the sample. These include schools with a focus on, among others, agricultural sciences, social education, health, biotechnology, or art and design.

[33]Following Card (1995), a long literature has used variation in the regional supply of educational infrastructure to instrument for educational choices.

Table 4.7: Instrumental Variables Regression

	Outcome variable:					
	Voc. HS	Higher sec. graduation	Plans to attend university	Knows where to apply	Knows planned occupation	Log median wage in planned occ.
	(1)	(2)	(3)	(4)	(5)	(6)
IV First Stage						
Regional share of	0.230***					
HS graduates	(0.072)					
F-test instrument	10.1					
OLS estimations						
Voc. HS		0.015	-0.074**	0.068**	0.017	0.044**
		(0.035)	(0.032)	(0.033)	(0.035)	(0.022)
IV estimations						
Voc. HS		0.031	-0.012	0.140*	0.035	0.118*
		(0.096)	(0.097)	(0.083)	(0.089)	(0.065)
Further controls	Yes	Yes	Yes	Yes	Yes	Yes
N	4114	3512	4114	4114	4114	2612

Note: The IV First Stage shows the Average Partial Effect (APE) from a Probit regression. The instrument is the district-level share of vocational vs. general HS graduates. For the second stage IV results, I follow Wooldridge (2010) and use the estimated propensity score from the first stage as instrument. All control variables from Table 4.3 are also included. Standard errors in parentheses, clustered at the school level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC4, own calculation.

The variation is on the level of districts (*Landkreise, kreisfreie Städte*), and since the estimations control for federal state dummies they use only the variation across districts within states.[34]

A valid instrument has to fulfill two conditions. First, the instrument has to be correlated with the treatment variable, conditional on all other covariates. I will show evidence below that this condition is satisfied. Second, the instrument must not be correlated with the error term in the outcome equation, a condition which is generally untestable. However, as shown in Appendix Table 4.A2, regressions of the instrument on the observable characteristics show little correlations with observable family background and pupil characteristics. It is thus not the case that e.g. particular types of parents self-select into regions based on the supply of vocational vs. general HS schools. Moreover, the instrument could also be invalid if it has a direct effect on the outcomes that does not operate through the channel of the school type attended. To filter out such indirect effects, I control for a large number of regional factors in the regressions, in particular federal state dummies, a city indicator, indicators for the presence of a university or another institution of tertiary education in the district, and an indicator for whether the district has a youth unemployment rate above the median.

[34]There are 401 districts in Germany. The regional data are obtained from the German Statistical Office and can be downloaded from `www.regionalstatistik.de`.

Table 4.7 presents the results. The first stage estimation shows that a one percentage point increase in the district's share of vocational HS graduates increases the probability to attend a vocational HS school by about 0.2 percentage points, holding all other factors equal. The instrument is highly statistically significant in the first stage with an F-statistic of 10.1. Next, consider the results of the IV estimation. The IV estimates have large standard errors, and thus have to be interpreted with some caution. Nevertheless, one interesting finding is that most of the IV estimates move further away from the OLS estimates – with, for example, the effect on planned university attendance turning less negative, and the occupational wage effect turning more positive. This is in line with the previous findings on the more negative selection into vocational HS schools. The effect on knowing where to apply and the positive occupational wage effect, however, remain positive and significantly different from zero in the IV estimations.

4.5.5 Further Analyses and Robustness Checks

Further Educational Outcomes. Appendix Table 4.A3 considers additional outcome variables by further disaggregating the various post-schooling pathways which are open to HS graduates. The alternatives to universities (which were the focus of the previous analyses) are universities of applied sciences (which also offer tertiary education but are more practically oriented than universities), dual studies (which combine studying at universities of applied sciences with firm-based vocational training), vocational training (either in the form of a firm-based apprenticeship or a full-time vocational school), or not continuing with education at all. The key finding is that the vocational HS pupils' lower aspirations to study at universities are matched by a higher rate of both planning universities of applied sciences and planning vocational training.[35]

Educational Attendance After HS Graduation. In Appendix Table 4.A4, I also replicate the analyses using as outcomes educational attendance in the fall after expected HS graduation. As argued above, these estimates are only partly informative since a large share of individuals (37 % among the vocational HS pupils, and 43 % among the general HS pupils) take a gap year in the first year after school and their future educational paths are not yet clear. The results show that there is no difference in university attendance, but that vocational HS pupils are more likely to attend the more practically-oriented paths (universities of applied sciences, dual studies or vocational training) immediately after school, and less likely to take a gap year (-9.2 ppts.). The considerably lower incidence of gap years among the vocational HS pupils is consistent with the findings in Section 4.5.2. that these pupils have a clearer plan where to apply after school. Moreover, the fact that more general HS pupils take a gap year suggests that university attendance for this group (both in levels and relative to the vocational HS pupils) is likely to be understated.[36]

[35] As some pupils state multiple of these plans, the estimated effects in the table do not add to zero.

[36] Among those that do a gap year, about 54 % said in the last year of school they planned to attend university later on.

The Duration of Schooling/ Age Effects. Vocational HS schools finish after 13th grade, while general HS schools finish after 12th grade in most federal states after a series of reforms carried out during the 2000s.[37] Thus, part of the differences between the two school types could be driven by the age difference, as well as differences in length of schooling. Meyer et al. (2015) show that the shortening of the duration of general HS school by one year has led more of the graduates to delay further education by one year and instead pursue a gap year after school. In line with this conjecture is the finding (discussed above) that the general HS pupils are more likely to take gap years than the vocational HS pupils.

However, for the outcomes related to pupils' educational plans in the year before expected HS graduation, this age difference is likely of minor importance. The survey question asking about pupils' future educational plans explicitly excludes gap years, i.e. it asks pupils what kind of education they want to pursue after a possible gap year. Moreover, I make use of the fact that in the federal states of Schleswig-Holstein and Rhineland-Palatinate general HS schools still finish after 13th grade. For these states, the estimated effects can't be driven by differences in age or the length of schooling. Appendix Table 4.A5 shows the previous analyses separately for the states of Rhineland-Palatinate and Schleswig-Holstein on the one hand ("13th grade sample"), and all other states on the other hand ("12th grade sample"). The effects for the 13th grade sample are estimated very imprecisely due to the small sample size. However, the positive effect on career planning and the positive effect on choosing occupations with higher wages are confirmed in this sample.

Using the Same Control Variables as in the Adult Cohort. It is also instructive to consider a specification excluding most 9th and 10th grade control variables (such as test scores or educational aspirations) and only including 10th grade school type. This is the same set of control variables that is also available in the Adult Cohort (see also Appendix Table 4.A1 for descriptive statistics of the variables in the Adult Cohort). As shown in Appendix Table 4.A6, this more restrictive specification yields an effect of -11.8 ppts. for the plan to attend university (as compared to -7.3 ppts. for the full specification). Taking the effects for the full specification as the benchmark, the more restrictive set of controls removes most of the bias that is removed by the full set of controls (67 % for HS graduation, 74 % for planned university attendance, and 71 % for wages). This suggests that although the estimates for the Adult Cohort (which will be discussed below) likely draw a somewhat too negative picture of vocational HS schools, they are still informative and remove an acceptable share of the selection bias.

[37] See e.g. Dahmann and Anger (2014) or Meyer et al. (2015) for a discussion.

4.5.6 Effects on Educational and Labour Market Outcomes in the Adult Cohort

I now consider the results from the NEPS Adult Cohort. This data set has the advantage of providing long-term outcomes, since for these older individuals their actual educational pathways and earnings after finishing school are observed. One limitation of the Adult Cohort is that it pools individuals from the birth cohorts 1955-86, raising some concerns about cohort effects. However, for the educational outcomes I don't find that the treatment effects differ strongly across birth cohorts (see the discussion below). Another limitation is that the Adult Cohort does not contain the extensive list of controls as the Pupil Cohort – in particular, while providing information on 10th grade school type, it lacks information on test scores and educational aspirations in 9th and 10th grade (see also Appendix Table 4.A1). Thus, given the more negative selection of the vocational HS pupils, the following estimates likely draw a too negative picture of the effect of vocational HS schools. Nevertheless, the results in Section 4.5.5 above for the Pupil Cohort suggest that the more restrictive set of controls still eliminates an acceptable share of the selection bias.

The results of the baseline specification (controlling for all available characteristics) are shown in Table 4.8. Column 1 of the table shows that there are no effects of attending a vocational HS school on HS graduation. Columns 2-5 show that vocational HS pupils are on average less likely to have attended university education by age 28 (-15.8 ppts.) and are more likely to have attended universities of applied sciences and vocational education (+11.8 and +3.6 ppts., respectively).

In terms of employment rates (Table 4.8, column 6), there are no differences between vocational and general HS pupils, with both statistically and economically insignificant point estimates. Keep in mind that for the present group of highly qualified individuals, baseline employment rates are very high with 89 % in the full sample. Next considering log monthly labour earnings, Appendix Table 4.A1 has shown that vocational HS pupils on average earn about 8.4 % less when considering the "raw" difference. However, this is completely driven by the more negative selection of the vocational HS pupils, and once observable characteristics are controlled for, the effect even turns positive with a point estimate of 5.3 % (see Table 4.8, column 8). However, the point estimate is not statistically significant.

The employment and earnings regressions in columns 6 and 8 of Table 4.8 have not controlled for HS graduation and post-school education and thus capture both the "direct" and the "indirect" effects of HS school type. To better understand these mechanisms, I also estimate regressions explicitly controlling for HS graduation and post-school education, which are shown in columns 7 and 9 of Table 4.8. In the log earnings regression, university education has the largest return among the different post-schooling pathways (with a coefficient of 0.485 relative to vocational education). The coefficient of vocational HS school increases from 0.053 to 0.082. This implies there is a positive "direct" effect of attending a vocational HS school (of about 8.2 %) which is counteracted partly by a negative "indirect" effect (of 5.3 % - 8.2 % = -2.9 %), because vocational HS pupils are less likely to attend universities which give higher returns. The net effect of attending a vocational HS school, however, seems to be positive (with the caveat that the effect is imprecisely

Table 4.8: Effects of attending a vocational HS school on post-school educational and labour market outcomes (Adult Cohort)

	Outcome variable:								
	Higher sec. graduation	Attended university	Attended university of applied sciences	Attended vocational educ.	Attended no post-school educ.	Employ-ment	Employ-ment	Log monthly labour earnings	Log monthly labour earnings
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Voc. HS	-0.002	-0.158***	0.118**	0.036	0.003	-0.010	-0.009	0.053	0.082
	(0.047)	(0.055)	(0.051)	(0.051)	(0.020)	(0.023)	(0.024)	(0.098)	(0.100)
HS graduation							0.041**		0.157**
							(0.018)		(0.064)
No post-school educ.							-0.096***		0.012
							(0.026)		(0.103)
Vocational educ.							Ref.		Ref.
University of appl. sc.							0.006		0.359***
							(0.015)		(0.060)
University							0.001		0.448***
							(0.014)		(0.050)
Further controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1377	1377	1377	1377	1377	1377	1377	1144	1144
N × T						5613	5613	3874	3874

Note: This table shows the coefficients of OLS regressions. All control variables from Appendix Table 4.A1, as well as a full set of year of birth dummies, are also included. Heteroskedasticity-robust standard errors in parentheses; for the employment and earnings regressions, the standard errors are clustered at the person level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC6, own calculation.

estimated).[38]

Since these regressions are performed for the pooled sample of all birth cohorts, it is also instructive to test for the presence of cohort effects. Appendix Table 4.A7 shows the effects on the educational outcomes separately for birth cohorts 1955-64, 1965-74, and 1975-86. The effect of attending a vocational HS school shows no time trend when considering the outcomes HS graduation or university attendance. If anything, vocational HS pupils among recent cohorts show a somewhat stronger inclination towards universities of applied sciences instead of vocational education. However, for all outcome variables, the interaction terms are jointly statistically insignificant.

Finally, a remaining question is whether the labour market returns to vocational HS school change over the lifecycle. Hanushek et al. (2016) argue that while vocational education helps individuals to have a smoother entry into the labour market at a young age, it provides considerably lower returns at older ages compared to academic education. I therefore estimate the employment and earnings regressions using interaction terms of the treatment dummy with three age groups (Age <35, Age 35-49, and Age 50+, respectively).[39] Results are shown in Appendix Table 4.A8, both without and with controls for post-school education. For employment, the effects are close to zero among all three age groups. For earnings, there is a more pronounced age pattern, with the returns to vocational HS school being highest among the <35 age group, and then falling markedly for the 35-49 and 50+ age groups. However, while the benefits of vocational HS school occur mainly for younger individuals, the effects do not become negative for older individuals.

4.6 Conclusion

This paper has used various identification strategies to estimate the effect of attending a vocational vs. a general higher secondary school on later outcomes. It has considered the case of Germany, where vocational HS schools provide an alternative route towards achieving a HS degree, and where the importance of these schools has grown over the last decades.

The results show that vocational HS pupils are less likely to plan attending university after school than general HS pupils, and more likely to plan attending universities of applied sciences or vocational education. Moreover, there is tentative evidence that, after controlling for selection, vocational HS pupils will face better labour market outcomes later in life. In the Pupil Cohort, the vocational HS pupils plan to work in occupations that offer higher wages than those occupations planned by the general HS pupils. These findings are supported by the Adult Cohort, for which actual labour market outcomes are observed, and where I find a positive (albeit not statistically

[38] Kreisman and Stange (2017) do a similar analysis when comparing the returns to vocational vs. academic coursework in U.S. high schools. Consistent with my analysis, they find a positive return to vocational coursework, which is driven mostly by those high school graduates who do not attend college.

[39] Like Hanushek et al. (2016), I use a synthetic cohort approach which ignores possible cohort effects. However, as discussed above, there is no evidence for cohort effects when considering the educational outcomes.

significant) effect of attending a vocational HS school on earnings. Moreover, I find that attending a vocational HS school improves pupils' career planning in the sense that they have a clearer knowledge about where to apply for after school. Overall, these schools seem to prepare their pupils for the labour market fairly well, given their more negatively selected student body.

To put these findings into a broader perspective, however, it has to be considered that the institutional setting considered in this study applies only to those pupils who have chosen to attend the higher secondary track (which provides access to tertiary education) in the first place and then choose between vocational or general HS schools. Thus, the evidence on vocational HS schools presented here can't be readily generalized to other forms of vocational schooling which do not grant eligibility for tertiary education and which are probably targeted at a less skilled student body. The results are, however, consistent with findings by Silliman and Virtanen (2018) on positive labour market effects of Finish vocational schools which also grant access to tertiary education.

In future research, it would be interesting to conduct a more detailed investigation of which type of HS school is most efficient for which pupils. While the analyses have highlighted possible effect heterogeneities by dimensions such as gender, cognitive skill, or the occupational field of the vocational HS school, the small sample sizes have precluded any definitive conclusions.[40] Finally, a natural question is to analyze further pathways of the younger cohorts once they will have finished school.

[40]Given the differences in education systems across federal states in Germany, it would also be of interest whether the effects differ by state. However, the data security restrictions of the NEPS data prohibit such a comparison.

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Appendix to Chapter 4

Appendix Table 4.A1: Descriptive Statistics (Adult Cohort)

	Full sample				Upgrader subsample			
	Vocational HS pupils	General HS pupils	Diff.		Vocational HS pupils	General HS pupils	Diff.	
Social Background Characteristics:								
Female	.48	.525	-.045		.5	.529	-.029	
Migration background	.2	.103	.097	***	.223	.21	.013	
Mother's Education:								
Lower sec.	.549	.458	.091	*	.582	.589	-.007	
Middle sec.	.287	.302	-.015		.275	.259	.016	
Higher sec.	.09	.099	-.009		.077	.098	-.021	
Tertiary	.074	.14	-.067	***	.066	.054	.012	
Father's Education:								
Lower sec.	.508	.412	.097	**	.529	.53	-.002	
Middle sec.	.186	.169	.018		.207	.148	.059	
Higher sec.	.068	.077	-.009		.057	.13	-.073	*
Tertiary	.237	.342	-.105	**	.207	.191	.016	
Mother's occupation:								
Low-skilled	.072	.06	.012		.096	.109	-.013	
Medium-skilled	.328	.326	.002		.34	.353	-.013	
High-skilled	.184	.219	-.035		.181	.151	.03	
Not employed	.416	.396	.02		.383	.387	-.004	
Father's occupation:								
Low-skilled	.128	.088	.04		.117	.134	-.017	
Medium-skilled	.288	.235	.053		.319	.303	.017	
High-skilled	.36	.54	-.18	***	.319	.412	-.093	
Not employed	.224	.138	.086	**	.245	.151	.093	*
Grew up with both parents	.856	.907	-.051		.862	.882	-.021	
No. of siblings	1.472	1.488	-.016		1.511	1.605	-.094	
Attended HS school in 10th grade	.248	.905	-.657	***	0	0	0	n/a

Regional Characteristics:								
Federal State:								
Schleswig-Holstein	.064	.033	.031		.074	.017	.058	*
Hamburg	.016	.021	-.005		.021	.034	-.012	
Lower Saxony	.224	.114	.11	***	.181	.143	.038	
Bremen	.008	.021	-.013		.011	.042	-.031	
Northrhine-Westphalia	.048	.337	-.289	***	.053	.395	-.342	***
Hesse	.112	.094	.018		.117	.185	-.068	
Rhineland-Palatinate	.072	.06	.012		.096	.059	.037	
Baden-Württemberg	.408	.149	.259	***	.436	.059	.377	***
Bavaria	.048	.155	-.107	***	.011	.067	-.057	**
Saarland	0	.017	-.017	***	0	0	0	n/a
Tertiary institution present in district	.456	.46	-.004		.479	.479	0	
University present in district	.312	.341	-.029		.34	.412	-.071	
City district	.328	.378	-.05		.34	.395	-.055	
Outcome Variables:								
HS graduation	.792	.883	-.091	***	.777	.824	-.047	
University attendance by age 28	.288	.571	-.283	***	.213	.521	-.308	***
Employed	.917	.911	.006		.935	.909	.026	
Monthly gross labour income	3395.2	3681.9	-286.7		3480.3	3245.6	234.7	
N	125	1253			119	94		

Note: Standard errors in parentheses, clustered at the school level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC4, own calculation.

Appendix Table 4.A2: Regression of the instrumental variable on observable characteristics

	Dependent variable: Regional share of voc. HS graduates	
Female	-0.004	(0.003)
Migration background	-0.005	(0.004)
Father's education: Lower sec.	Ref.	
Father's education: Middle sec.	-0.006	(0.004)
Father's education: Higher sec.	-0.003	(0.004)
Father's education: Tertiary	0.001	(0.005)
Father's education: Missing	-0.002	(0.004)
Mother's education: Lower sec.	Ref.	
Mother's education: Middle sec.	0.002	(0.004)
Mother's education: Higher sec.	-0.001	(0.005)
Mother's education: Tertiary	-0.004	(0.005)
Mother's education: Missing	-0.001	(0.005)
Father's occupation:	Ref.	
Father's occupation:	-0.001	(0.004)
Father's occupation:	0.000	(0.005)
Father's occupation:	0.005	(0.007)
Father's occupation: Missing	-0.003	(0.005)
Mother's occupation:	Ref.	
Mother's occupation:	0.002	(0.003)
Mother's occupation:	-0.005	(0.004)
Mother's occupation:	0.003	(0.004)
Mother's occupation: Missing	-0.002	(0.003)
Grew up with both parents	0.008***	(0.003)
Grew up with both parents: Missing	0.001	(0.007)
Parents care about school grades	0.004*	(0.003)
Parents care about school grades: Missing	0.012	(0.009)
Parents want tertiary education	-0.002	(0.003)
Parents want tertiary education: Missing	-0.007	(0.005)
City district	0.008	(0.016)
University of appl. sciences present in district	0.020	(0.013)
University present in district	-0.018	(0.015)
Unemployment rate above median	-0.031**	(0.015)
Attended higher sec. in 10th grade	0.014	(0.010)
9th grade math test score	0.000	(0.002)
9th grade math test score: Missing	0.012	(0.017)
9th grade reading test score	-0.001	(0.002)
9th grade reading test score: Missing	0.001	(0.006)
9th grade ICT test score	-0.001	(0.002)
9th grade ICT test score: Missing	-0.022	(0.014)
Abitur is realistic (9th grade)	-0.003	(0.004)
Abitur is realistic (9th grade): Missing	0.005	(0.007)
Abitur is realistic (10th grade)	0.002	(0.004)
Abitur is realistic (10th grade): Missing	0.006	(0.011)
Want to complete Abitur (9th grade)	0.008	(0.008)
Want to complete Abitur (9th grade): Missing	0.003	(0.010)
Want to complete Abitur (10th grade)	-0.001	(0.007)

Want to complete Abitur (10th grade): Missing	-0.002	(0.013)
Reads a lot	0.003	(0.002)
Reads a lot: Missing	0.001	(0.008)
Attends cultural activities	-0.005*	(0.003)
Attends cultural activities: Missing	-0.004	(0.012)
Big 5: Extraversion	0.002**	(0.001)
Big 5: Agreeableness	-0.002	(0.002)
Big 5: Conscientiousness	-0.002	(0.001)
Big 5: Neuroticism	0.001	(0.001)
Big 5: Openness	0.000	(0.001)
Big 5: Missing	-0.000	(0.005)
Planned occ. in 10th grade: Military, Agriculture	-0.001	(0.014)
Planned occ. in 10th grade: Production, Construction	Ref.	
Planned occ. in 10th grade: Natural Sciences, IT	-0.005	(0.006)
Planned occ. in 10th grade: Transport, Logistics, Security	-0.010*	(0.006)
Planned occ. in 10th grade: Commercial services	0.007	(0.008)
Planned occ. in 10th grade: Management, Law, Admin.	0.004	(0.005)
Planned occ. in 10th grade: Health, Social Serv., Education	0.007	(0.005)
Planned occ. in 10th grade: Media, Culture, Literature	-0.001	(0.006)
Planned occ. in 10th grade: Missing	-0.005	(0.023)
Log daily wage of planned occ. (10th grade)	-0.003	(0.005)
Log daily wage of planned occ. (10th grade) : Missing	1.740	(2.630)
Constant	0.337***	(0.030)
N	4114	

Note: The table shows the regression of the instrumental variable used in Section 4.5.4 (the district-level share of vocational HS graduates) on the full set of control variables. Standard errors in parentheses, clustered at the school level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC4, own calculation.

Appendix Table 4.A3: Further outcome variables

	Outcome variable: Plans to attend...				
	University	University of applied sciences	Dual studies	Vocational education	No further education
	(1)	(2)	(3)	(4)	(5)
Full sample					
Voc. HS	-0.073**	0.046**	-0.009	0.056**	-0.020
	(0.032)	(0.023)	(0.023)	(0.026)	(0.027)
N	4114	4114	4114	4114	4114
Upgrader subsample					
Voc. HS	-0.073	-0.012	-0.005	0.143***	-0.053
	(0.046)	(0.036)	(0.029)	(0.041)	(0.038)
N	611	611	611	611	611
Further controls	Yes	Yes	Yes	Yes	Yes

Note: This table shows coefficients from OLS regressions. All control variables from Table 4.3 are included. Standard errors in parentheses, clustered at the school level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC4, own calculation.

Appendix Table 4.A4: Educational attendance in the fall after expected HS graduation

	Outcome variable:				
	University	University of applied sciences	Dual studies	Vocational education	Gap year/ Other
	(1)	(2)	(3)	(4)	(5)
Full sample					
Voc. HS	0.016	0.020	0.024	0.053*	-0.113***
	(0.030)	(0.019)	(0.016)	(0.029)	(0.037)
N	3512	3512	3512	3512	3512
Upgrader subsample					
Voc. HS	-0.045	-0.007	0.053**	0.112**	-0.113**
	(0.040)	(0.030)	(0.025)	(0.043)	(0.053)
N	539	539	539	539	539
Further controls	Yes	Yes	Yes	Yes	Yes

Note: This table shows coefficients from OLS regressions. All control variables from Table 4.3 are included. Standard errors in parentheses, clustered at the school level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC4, own calculation.

Appendix Table 4.A5: States with General HS school after 13th vs. 12th Grade

	Outcome variable:				
	Higher sec. graduation	Plans university	Knows where to apply	Knows planned occupation	Log median wage in planned occ.
	(1)	(2)	(3)	(4)	(5)
Federal states where general HS schools finish after 13th grade					
Voc. HS	0.043	-0.048	0.103	-0.152	0.098
	(0.154)	(0.099)	(0.117)	(0.142)	(0.068)
N	266	324	324	324	203
Federal states where general HS schools finish after 12th grade					
Voc. HS	0.006	-0.081**	0.077**	0.030	0.043*
	(0.036)	(0.033)	(0.035)	(0.036)	(0.023)
N	3246	3790	3790	3790	2409
Further controls	Yes	Yes	Yes	Yes	Yes

Note: General HS schools finish after 13th grade in the Federal States of Schleswig-Holstein and Rhineland-Palatinate, while general HS schools generally finish after 12th grade in all other states. This table shows coefficients from OLS regressions. All control variables from Table 4.3 are included. Standard errors in parentheses, clustered at the school level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC4, own calculation.

Appendix Table 4.A6: The Role of Different Control Variables

	Full sample			Upgrader subsample		
	No controls	Adult Cohort controls	Full controls	No controls	Adult Cohort controls	Full controls
	(1)	(2)	(3)	(4)	(5)	(6)
Outcome: Higher secondary graduation						
Voc. HS	-0.174***	-0.047	0.015	0.011	-0.012	0.033
	(0.026)	(0.035)	(0.035)	(0.046)	(0.050)	(0.054)
N	3512	3512	3512	539	539	539
Outcome: Plans to attend university						
Voc. HS	-0.246***	-0.118***	-0.073**	-0.115***	-0.094**	-0.073
	(0.025)	(0.032)	(0.032)	(0.040)	(0.043)	(0.046)
N	4114	4114	4114	611	611	611
Outcome: Knows where to apply after school						
Voc. HS	0.086***	0.051	0.068**	0.067*	0.076*	0.085*
	(0.023)	(0.031)	(0.033)	(0.037)	(0.043)	(0.046)
N	4114	4114	4114	611	611	611
Outcome: Has planned occupation						
Voc. HS	0.018	0.007	0.018	0.007	0.045	0.030
	(0.026)	(0.034)	(0.035)	(0.039)	(0.044)	(0.046)
N	4114	4114	4114	611	611	611
Outcome: Log median daily wage of planned occupation						
Voc. HS	-0.052**	0.016	0.044**	0.060*	0.028	0.053*
	(0.022)	(0.022)	(0.022)	(0.035)	(0.028)	(0.029)
N	2612	2612	2612	398	398	398

Note: "Adult Cohort controls" are social background characteristics, regional characteristics and 10th grade school type (see Table 4.3). "Full controls" include all control variables in Table 4.3. This table shows coefficients from OLS regressions. Standard errors in parentheses, clustered at the school level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC4, own calculation.

Appendix Table 4.A7: Effects of attending a vocational HS school on educational outcomes, by birth cohort (Adult Cohort)

	HS graduation	Attended university	Attended university of applied sciences	Attended vocational educ.	Attended no post-school educ.
	(1)	(2)	(3)	(4)	(5)
Effect of Voc. HS for...					
Birth cohort 1955-64	-0.022	-0.150*	0.104	0.036	0.011
	(0.081)	(0.086)	(0.084)	(0.082)	(0.039)
Birth cohort 1965-74	-0.009	-0.177**	0.092	0.062	0.023
	(0.073)	(0.078)	(0.080)	(0.080)	(0.035)
Birth cohort 1975-86	0.009	-0.150*	0.155**	0.014	-0.020
	(0.067)	(0.079)	(0.079)	(0.072)	(0.023)
F-test for joint significance of interaction terms					
p-value	0.946	0.954	0.819	0.892	0.482
Further controls	Yes	Yes	Yes	Yes	Yes
N	1377	1377	1377	1377	1377

Note: This table shows the coefficients of OLS regressions based on interaction terms between the treatment dummy "Voc. HS" and the birth cohort dummies. All control variables from Appendix Table 4.A1 are also included. Standard errors in parentheses, clustered at the person level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC6, own calculation.

Appendix Table 4.A8: Effects of attending a vocational HS school on labour market outcomes, by age group (Adult Cohort)

	Employment		Log earnings	
	(1)	(2)	(3)	(4)
Effect of Voc. HS for...				
Age 23-34	0.002	-0.004	0.245*	0.239*
	(0.034)	(0.033)	(0.110)	(0.108)
Age 35-49	-0.021	-0.019	0.006	0.050
	(0.026)	(0.027)	(0.107)	(0.108)
Age 50-61	-0.000	0.004	-0.011	0.068
	(0.042)	(0.045)	(0.178)	(0.185)
F-test for joint significance of interaction terms				
p-value	0.556	0.697	0.048	0.116
Further controls	Yes	Yes	Yes	Yes
Controls for HS graduation and post-school education		Yes		Yes
N	1377	1377	1144	1144
N × T	5613	5613	3874	3874
Adj. R^2	0.292	0.299	0.188	0.264

Note: This table shows the coefficients of OLS regressions based on interaction terms between the treatment dummy "Voc. HS" and the age group dummies. Columns (2) and (4) additionally control for HS graduation and dummies for the four post-school education categories and their interactions with the age group dummies. All control variables from Appendix Table 4.A1 are also included. Standard errors in parentheses, clustered at the person level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: NEPS SC6, own calculation.

Chapter 5

Cohort Changes in Intergenerational Mobility

5.1 Introduction

Intergenerational mobility – how strongly a child's life outcomes are associated with those of her parents – is a pressing issue in many countries (see e.g. Chetty et al. 2014a,b, or the literature reviews in Björklund and Jäntti 2009 or Black and Devereux 2010). One important question in this context is how educational outcomes vary between children from different parental backgrounds, in particular in the face of rising differentials in labour market outcomes between workers of different skills. In this paper, we analyze trends in educational participation of children coming from different parental socio-economic status (SES) over four decades of West German birth cohorts. Similar to many other industrialized countries, Germany has seen an educational expansion over the last decades, triggered by rising public investment and other institutional reforms (Becker et al. 2006, Heineck and Riphahn 2009). This prompts the question as to which children did benefit most from this expansion. Germany is also an interesting case because its secondary school system, in which pupils are typically tracked already at age 10, is sometimes argued to contribute to a larger role of parents in determining the schooling of their children and lower intergenerational mobility (Betts 2011, Pekkarinen et al. 2009). However, the tracked system also provides opportunities to revise decisions made after early tracking at later stages of the educational career (Dustmann et al. 2017, Biewen and Tapalaga 2017).

In this paper, we focus on West German birth cohorts 1944 to 1986. We provide a comprehensive picture of how the educational biographies and labour market outcomes have changed across cohorts, and how these patterns differ between children coming from different parental SES groups. For the educational outcomes, we provide an in-depth analysis of different pathways in secondary schooling and postsecondary education, including various "second chance" options in the system.

We make three contributions to the existing literature. First, many studies have only considered a limited set of educational outcomes, and not taken into account complete educational biographies.[1] While recent papers analyze upgrading within the secondary school system (Puhani and Mühlenweg 2010, Dustmann et al. 2017, Biewen and Tapalaga 2016), less is known on how children from different groups utilize upgrading possibilities. Second, the previous literature has typically focused on trends in educational gaps between children of different parental education or occupation groups (Dustmann 2004, Heineck and Riphahn 2009, Biewen and Tapalaga 2016). One problem with this approach is that the share of educational or occupational groups in the parental generation has also shifted considerably over time, making interpretation of these gaps difficult. In our paper, we will address this issue by imputing parental earnings based on the father's occupation and dividing the population into quintiles within each cohort. This allows to address the more natural question of how, say, children from the top or the bottom fifth of the population have fared over time. Third, we will integrate an analysis of both educational and labour market outcomes depending on parental background. The aforementioned literature on intergenerational inequality in education has typically not considered labour market outcomes, due to a lack of suitable data on children's labour market biographies. In turn, the literature on intergenerational income (or earnings) mobility often does not explicitly analyze educational outcomes.[2]

Our results can be summarized as follows. We find rising educational participation (graduation from a higher track secondary school and attendance of tertiary education) for children across the whole parental SES distribution, especially among women. However, as these increases were most pronounced among children of high parental SES, educational disparities by parental background have increased. For example, when comparing the 1944-54 and 1977-86 birth cohorts, the share who has obtained a higher secondary school degree by age 24 has increased by 15 ppts. for men from the bottom parental SES quintile, but by 33 ppts. for men from the top parental SES quintile. For women, these increases were 21 ppts. for those from the bottom quintile, and 42 ppts. for those from the top quintile. We also consider "second chance" options in the German education system (such as "upgrading" to a higher secondary school degree after 10th grade, or the option to study at university after completing vocational training) and find that these options do not contribute substantially to reducing the gaps. Finally, for the most recent cohorts we consider (those born 1977-86), we document widening gaps between parental background groups in terms of labour market outcomes, driven by a rising nonemployment risk for children of low parental SES.

The results of our study are consistent with evidence on other industrialized countries that the educational expansion of the last decades has enhanced, rather than mitigated, inequality between

[1] For example, Heineck and Riphahn (2009), Dustmann (2004) and Schmipl-Neimanns (2000) focus on secondary school degrees, while Mayer et al. (2007) or Riphahn and Schieferdecker (2012) study tertiary enrollment for higher secondary graduates.

[2] The literature on intergenerational income mobility for the US includes, among others, Solon (1992), Zimmerman (1992), Mazumder (2005), Aaronson and Mazumder (2008), Chetty et al. (2014a,b). For the UK, see Nicoletti and Ermisch (2008) and Blanden et al. (2007). For Germany, see Schnitzlein (2016).

children from different parental backgrounds. Lindley and Machin (2012), comparing British birth cohorts from 1958 and 1970, find that rising education of the younger generation was mainly concentrated among children from high-income families, in particular with respect to attaining postgraduate education. They argue that this trend, coupled with rising returns to education, has reduced social mobility over time. For the U.S., Belley and Lochner (2007) as well as Bailey and Dynarski (2011) compare the 1961-1964 and 1979-1982 birth cohorts and document a rising role of parental income for college attendance. The latter study also finds that college attendance has increased most strongly for women from high-income parents.

The paper continues with Section 5.2, which describes the data. Section 5.3 presents the results on educational transitions, while Section 5.4 provides the corresponding analyses of labour market outcomes. Section 5.5 concludes.

5.2 Data

The paper uses data from the Starting Cohort 6 of the National Educational Panel Study (NEPS), see also Blossfeld et al. (2011) for a further description. The NEPS SC6 is a survey of about 17.000 individuals from the birth cohorts 1944 to 1986, who were retrospectively asked about their complete educational and labour market biographies. The data set contains information in spell format on a monthly basis. We use the first seven waves of the data, corresponding to the survey years 2007 to 2016.[3] We keep only individuals born in West Germany, since the educational systems in communist East Germany or countries outside of Germany differ considerably, resulting in a sample size of 11631 individuals. We use survey weights provided by the NEPS in all analyses.[4]

In the NEPS survey, respondents provide information on their father's occupation when the respondent was 15 years old. This information allows us to impute the father's labour earnings using an auxiliary data set provided by Hausmann et al. (2015), which shows the median earnings by occupation for each year 1976-2010.[5] Ideally we would have information dating back to 1959, the year the oldest individuals in the NEPS survey (born 1944) turned 15. We thus have to impute the 1976 information for all years dating back to 1959. For respondents who report that their father

[3]The NEPS Adult Cohort is a follow-up to the data set *Working and Learning in a Changing World (ALWA)* collected by the Institute for Employment Research (IAB). In particular, about half of the NEPS sample is from the old ALWA study, while the other half has been sampled anew.

[4]In most of the paper, we compare the outcomes of individuals grouped by their birth cohorts (e.g. those born in 1955-65). When computing the averages per cohort group, we account for the fact that the distribution of birth years is not uniform within groups (e.g., within the 1955-65 group, there are more individuals born in the early 1960s than in the late 1950s). This is done by multiplying the survey weight for each observation with the inverse of the cohort size.

[5]This data set is constructed based on administrative data from the Sample of Integrated Employment Biographies (SIAB). The SIAB contains records of a 2 % random sample of all (West) German employees covered by social security. The wage information is merged to the NEPS data at the 3-digit level of the occupational classification used by the German Statistical Office.

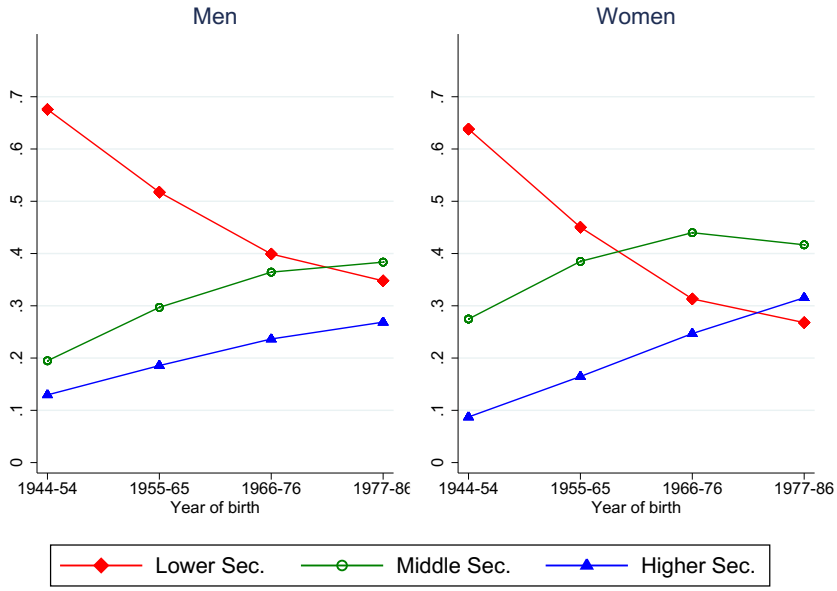
was not employed when they were 15, we impute zero earnings. Finally, we partition the NEPS respondents into quintiles of parental earnings within each cohort. Earnings are set to missing if the respondent had a father who worked as a self-employed or civil servant (for whom the SIAB does not contain earnings information). We present separate statistics for this subgroup.

5.3 Cohort Trends in Education

5.3.1 First School Degrees

Figure 5.1 shows the share of each birth cohort having obtained a lower, middle or higher secondary degree as their first school degree. The first school degree is essentially determined by the tracking of pupils after 5th grade. However, note that given possible "upgrading" options after the first degree (which we will discuss in more detail below), the first school degree does not necessarily correspond to the final school degree.

Figure 5.1: First secondary school degree



Note: The graph shows the share of each birth cohort having obtained a lower, middle, or higher secondary degree as their first secondary school degree. Source: NEPS SC6, own calculation.

The share of lower secondary graduates has decreased sharply over time, while the share of middle and higher secondary graduates has increased. The graph also highlights important gender differences. In terms of higher secondary degrees, women are behind men in the cohorts born up to the mid-1960s, but they catch-up rapidly and eventually overtake men in the cohorts born in the early 1980s. Among the 1977-86 cohort, 32 % of women have a higher sec. degree as their first

degree, compared to 27 % of men. This reversal of the gender gap in education has been found in a large number of industrialized countries.[6] But a remarkable result is that already for the oldest cohorts, women were much less likely than men to obtain a lower secondary degree and more likely to obtain a middle secondary degree. In other words, while the female advantage at the top of the schooling distribution has only emerged for the most recent cohorts, the female advantage at the bottom was already present in the oldest cohorts.

Table 5.1 shows the trends in first school degrees separately by the quintile of parental SES. The educational expansion is visible for all parental SES groups, although there are some noticeable differences in the magnitudes. Among men, those from the bottom quintile of parental SES have seen a large shift away from the lower secondary degree (-22.5 ppts. from the 1944-54 to the 1977-86 cohorts) and towards the middle secondary degree (+18.3 ppts.), but with a surprisingly small change in the share reaching a higher secondary degree (+4.1 ppts.). In contrast, men from the fourth and fifth quintile of parental SES have seen a dramatic increase in higher secondary graduation (+30.0 and +19.8 ppts., respectively). In other words, social selectivity in terms of reaching a higher secondary degree has risen across cohorts, with the gap between men from the top and the lowest SES-quintile increasing from 14.2 ppts. to 29.9 ppts. Men from self-employed or civil servant parents also show considerable progress, with an increase in higher secondary graduation of 18.4 ppts. across cohorts. For women, who were able to catch-up relative to men, the increases in higher secondary graduation have been stronger in all subgroups. But as shown in Table 5.1, it were especially the women from high-SES parents who have made the largest progress: higher secondary graduation rates increased by 10.6 ppts. among women from the bottom SES quintile, but by 30.2 ppts. among women from the top quintile. There is also the striking pattern that between the 1966-76 and 1977-86 cohorts, higher secondary graduation has stagnated (or even declined) for men and women from the bottom two quintiles of parental SES, but increased further considerably for the third and fourth quintiles.

[6] See OECD (2015) and Becker et al. (2010), as well as Goldin et al. (2006) and Fortin et al. (2015) for the US, or Riphahn and Schwientek (2015) for Germany.

Table 5.1: First secondary school degrees, by birth cohort and quintile of parental SES

	Men					Women				
	1944-54	1955-65	1966-76	1977-86	Change 44-54 77-86	1944-54	1955-65	1966-76	1977-86	Change 44-54 77-86
A. Lower sec. degree										
All	.676	.517	.399	.348	-.328	.638	.45	.313	.268	-.37
By SES quintile:										
Lowest	.709	.726	.56	.484	-.225	.727	.669	.431	.492	-.235
Second	.805	.703	.552	.525	-.28	.785	.596	.476	.328	-.457
Third	.737	.6	.546	.413	-.324	.69	.527	.449	.26	-.43
Fourth	.738	.481	.292	.187	-.551	.664	.448	.225	.136	-.528
Highest	.471	.276	.311	.211	-.26	.397	.225	.058	.066	-.331
Father self-empl. /civil servant	.624	.444	.307	.312	-.312	.591	.349	.236	.245	-.346
Gap Q5 vs. Q1	-0.238	-0.450	-0.249	-0.273	-0.036	-0.330	-0.444	-0.373	-0.425	-0.096
	(0.073)	(0.048)	(0.056)	(0.068)	(0.091)	(0.072)	(0.047)	(0.053)	(0.063)	(0.085)
B. Middle sec. degree										
All	.195	.297	.364	.384	.189	.275	.385	.44	.417	.142
By SES quintile:										
Lowest	.225	.189	.323	.408	.183	.264	.263	.443	.392	.128
Second	.163	.218	.348	.416	.253	.206	.351	.423	.572	.366
Third	.171	.323	.344	.424	.253	.247	.398	.398	.536	.289
Fourth	.173	.354	.462	.423	.25	.277	.405	.489	.454	.177
Highest	.32	.335	.279	.382	.062	.413	.474	.447	.442	.029
Father self-empl. /civil servant	.199	.314	.391	.325	.126	.28	.407	.436	.315	.035
Gap Q5 vs. Q1	0.095	0.146	-0.044	-0.026	-0.121	0.149	0.211	0.004	0.050	-0.099
	(0.063)	(0.045)	(0.056)	(0.071)	(0.088)	(0.068)	(0.047)	(0.059)	(0.071)	(0.090)
C. Higher sec. degree										
All	.129	.186	.237	.269	.14	.087	.165	.247	.315	.228
By SES quintile:										
Lowest	.067	.085	.116	.108	.041	.01	.068	.125	.116	.106
Second	.032	.079	.099	.059	.027	.009	.053	.101	.1	.091
Third	.093	.077	.11	.163	.07	.063	.075	.152	.204	.141
Fourth	.089	.165	.246	.389	.3	.058	.147	.286	.409	.351
Highest	.209	.389	.41	.407	.198	.19	.301	.495	.492	.302
Father self-empl. /civil servant	.178	.242	.301	.362	.184	.128	.244	.328	.44	.312
Gap Q5 vs. Q1	0.142	0.304	0.294	0.299	0.157	0.181	0.232	0.369	0.375	0.195
	(0.053)	(0.037)	(0.049)	(0.062)	(0.076)	(0.042)	(0.035)	(0.049)	(0.065)	(0.072)
N	1399	2086	1346	948		1243	2238	1485	886	

Note: The table shows first secondary school degrees by birth cohort and parental SES. Parental SES quintiles are defined based on the median wage in the father's occupation when the respondent was 15. Father's wages are merged based on administrative data provided by Hausmann et al. (2015), and quintiles are defined within each cohort. Source: NEPS-SC6, own calculation. Standard errors in parentheses.

5.3.2 Upgrading School Degrees

The previous analyses have considered a person's first school degree, which is essentially determined by the secondary school track a person is assigned to after primary school at age 10.[7] However, the German school system allows various options to revise the early tracking decision later on (see also Dustmann et al. 2017, Biewen and Tapalaga 2017, or Jacob and Tieben 2010).

In the following, we distinguish between two "indirect" pathways to the higher secondary degree.[8] First, pupils who finished with a middle secondary degree after 10th grade (at age 16) have the option to directly continue schooling on the higher secondary track afterwards, provided that they reach a certain grade point average. These pupils can either switch to traditional higher secondary schools (*allgemeinbildende Gymnasien*), or to specialized vocational higher secondary schools which put a greater focus on occupation-specific subjects.[9] For students who upgrade directly after 10th grade, one motivation can be to increase chances in the apprenticeship market, i.e. to obtain access to more qualified and higher-paid occupations after leaving school, see e.g. Fitzenberger and Lickleder (2015).[10]

The second "indirect" pathway is that a pupil leaves school after 10th grade of middle secondary school and enters vocational training (either via a firm-based apprenticeship or a full-time vocational school), and then completes the higher secondary degree after having completed vocational training. To that end, there exist also specialized schools which are directed to these older individuals with completed vocational training. Some of these institutions are full-time schools, while others can be attended parallel to working.[11]

Figure 5.2 shows the share of the total population who are "direct" higher secondary graduates (i.e. those that had the higher secondary degree as their first school degree) and the share of the two types of "indirect" higher secondary graduates. The sharp increase in the share of "direct" higher secondary graduates has already been documented in Figure 5.1, but "indirect" paths have grown as well. The share of individuals who reach the higher secondary degree via upgrading directly after middle secondary school ("Middle sec. $\rightarrow$ Higher sec.") increased from 4 % in the 1944-54 cohort to 10 % in the 1977-86 cohort for men, and from 3 % to 13 % for women. The share of individuals who reach the higher secondary degree after having completed vocational training ("Middle sec. $\rightarrow$ Voc $\rightarrow$ Higher sec.") increased as well, but at a slower pace (from 3 %

[7] Switching tracks *before* having obtained a first degree is in principle possible, but very uncommon.

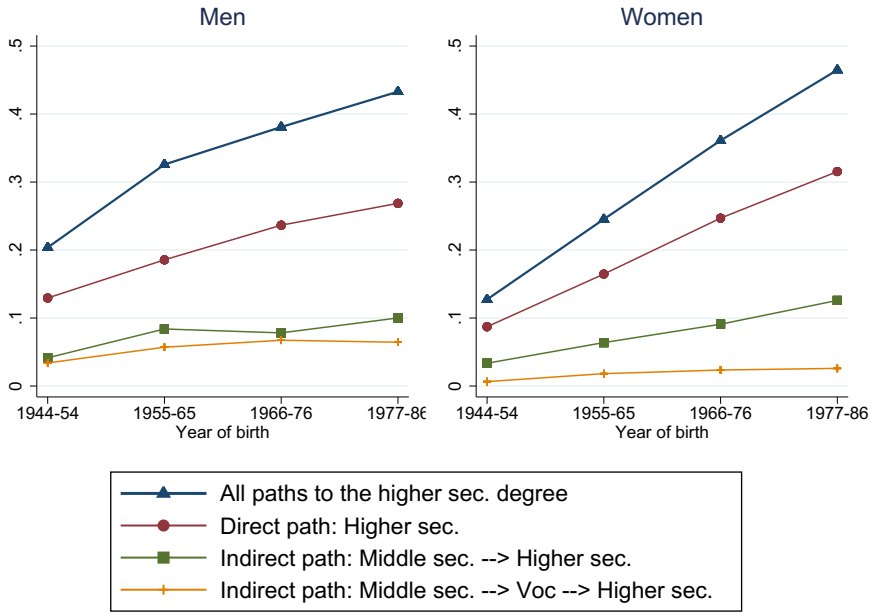
[8] Unless otherwise stated, the term "higher secondary degree" includes both *Fachhochschulreife* and *Abitur*, with the former only providing access to universities of applied sciences. Differences between these two types of higher secondary degrees will be discussed further below.

[9] The institutional settings vary by federal states. Vocational higher secondary schools include e.g. *Berufliches Gymnasium*, *Fachoberschule*, or *Berufskolleg*.

[10] For example, apprenticeships as a bank clerk (a high-paying occupation in the vocational training system) nowadays typically require a higher secondary degree.

[11] For a detailed explanation of the institutional settings in the different German federal states, see BA (2007). Sterrenberg (2014) and the literature cited therein also provides further information on second-chance schooling in Germany.

Figure 5.2: Direct and indirect pathways towards the higher secondary degree



Note: The graph shows the share of each birth cohort having obtained a higher secondary degree on the direct path or on one of the two indirect pathways. Further definitions see text. Source: NEPS SC6, own calculation.

to 6 % for men, and from 1 % to 3 % for women). The latter pathway also turns out to be much more prevalent among men than among women.

We now analyze whether the possibility to upgrade at later stages of the educational career contributes to overcoming the strong intergenerational persistence of school degrees associated with early tracking at age 10. Table 5.2 shows the share of children from different parental SES quintiles completing each of the possible higher secondary pathways. The direct path to the higher secondary degree is clearly the most socially selective, driving most of the total gap in higher secondary graduation (both in levels and in trends). The pathway "Middle sec. $\rightarrow$ Higher sec." also is slightly socially selective for men in the 1955-65 and 1966-76 cohorts (as indicated by the positive gap), although that seems to decline for the most recent cohorts. Only the pathway "Middle sec. $\rightarrow$ Voc $\rightarrow$ Higher sec." is more or less socially neutral, as indicated by the gap being close to zero (which means that children from the different parental SES quintiles have rather similar chances to follow this path).

An interesting pattern is that for men from the lowest and the second parental SES quintiles, most of their increase in higher secondary graduation over time comes from increases in indirect, as opposed to direct, higher secondary graduation. For example, for men from the bottom quintile, indirect higher secondary graduation increased by 14.5 ppts., while direct higher secondary graduation increased by merely 4.1 ppts. In that sense, the indirect degrees contributed to the catch-up of

Table 5.2: Direct vs. indirect higher sec. graduation, by quintile of parental SES

	Men					Women				
	1944-54	1955-65	1966-76	1977-86	Change 44-54 77-86	1944-54	1955-65	1966-76	1977-86	Change 44-54 77-86
A. All paths to higher sec. degree										
All	.204	.326	.381	.433	.229	.127	.245	.361	.465	.338
By SES quintile:										
Lowest	.115	.168	.243	.26	.145	.064	.125	.226	.269	.205
Second	.086	.18	.224	.251	.165	.043	.115	.151	.239	.196
Third	.155	.194	.208	.345	.19	.074	.149	.257	.347	.273
Fourth	.162	.298	.362	.58	.418	.1	.248	.396	.514	.414
Highest	.287	.595	.598	.62	.333	.228	.433	.606	.643	.415
Father self-empl. /civil servant	.261	.387	.468	.507	.246	.182	.323	.473	.62	.438
Gap Q5 vs. Q1	0.172 (0.063)	0.427 (0.045)	0.355 (0.055)	0.360 (0.070)	0.188 (0.088)	0.165 (0.050)	0.308 (0.041)	0.379 (0.055)	0.374 (0.070)	0.210 (0.080)
B. Direct path: Higher sec.										
All	.129	.186	.237	.269	.14	.087	.165	.247	.315	.228
By SES quintile:										
Lowest	.067	.085	.116	.108	.041	.01	.068	.125	.116	.106
Second	.032	.079	.099	.059	.027	.009	.053	.101	.1	.091
Third	.093	.077	.11	.163	.07	.063	.075	.152	.204	.141
Fourth	.089	.165	.246	.389	.3	.058	.147	.286	.409	.351
Highest	.209	.389	.41	.407	.198	.19	.301	.495	.492	.302
Father self-empl. /civil servant	.178	.242	.301	.362	.184	.128	.244	.328	.44	.312
Gap Q5 vs. Q1	0.142 (0.053)	0.304 (0.037)	0.294 (0.049)	0.299 (0.062)	0.157 (0.076)	0.181 (0.042)	0.232 (0.035)	0.369 (0.049)	0.375 (0.065)	0.195 (0.072)

– continues on next page –

Table 5.2 (continued): Direct vs. indirect higher sec. graduation, by quintile of parental SES

	Men					Women				
	1944-54	1955-65	1966-76	1977-86	Change 44-54 77-86	1944-54	1955-65	1966-76	1977-86	Change 44-54 77-86
					– continued –					
C. Indirect path: Middle sec. → Higher sec.										
All	.042	.084	.078	.1	.058	.034	.064	.091	.126	.092
By SES quintile:										
Lowest	.008	.055	.057	.104	.096	.042	.055	.08	.129	.087
Second	.012	.048	.068	.103	.091	.033	.053	.033	.116	.083
Third	.043	.062	.046	.097	.054	0	.067	.094	.121	.121
Fourth	.04	.082	.053	.114	.074	.039	.079	.083	.091	.052
Highest	.043	.139	.142	.14	.097	.028	.087	.067	.143	.115
Father self-empl. /civil servant	.055	.088	.087	.089	.034	.046	.061	.122	.139	.093
Gap Q5 vs. Q1	0.035	0.084	0.085	0.036	0.001	-0.014	0.032	-0.012	0.014	0.028
	(0.032)	(0.027)	(0.031)	(0.044)	(0.051)	(0.027)	(0.024)	(0.034)	(0.049)	(0.050)
D. Indirect path: Middle sec. → Vocational → Higher sec.										
All	.034	.057	.067	.064	.03	.007	.018	.024	.026	.019
By SES quintile:										
Lowest	.04	.028	.069	.047	.007	.012	.001	.022	.024	.012
Second	.042	.053	.057	.09	.048	.001	.008	.016	.023	.022
Third	.025	.055	.052	.085	.06	.011	.007	.012	.022	.011
Fourth	.032	.055	.062	.08	.048	.002	.022	.027	.015	.013
Highest	.041	.07	.055	.073	.032	.01	.053	.044	.008	-.002
Father self-empl. /civil servant	.029	.057	.08	.056	.027	.008	.02	.023	.04	.032
Gap Q5 vs. Q1	0.001	0.042	-0.014	0.025	0.025	-0.002	0.052	0.022	-0.015	-0.013
	(0.029)	(0.023)	(0.030)	(0.036)	(0.045)	(0.012)	(0.013)	(0.018)	(0.023)	(0.026)
N	1399	2086	1346	948		1243	2238	1485	886	

Note: The table shows the share of each birth cohort and parental SES quintile who have obtained the higher secondary degree on the direct pathway or on one of the two indirect pathways. Parental SES quintiles are defined based on the median wage in the father's occupation when the respondent was 15. Father's wages are merged based on administrative data provided by Hausmann et al. (2015), and quintiles are defined within each cohort. Source: NEPS-SC6, own calculation. Standard errors in parentheses.

men from low-SES parents. However, these changes could not compensate for the strong increase in inequality associated with direct higher secondary graduation.

Taken together, our findings show that while a large and growing number of individuals make use of the flexibility options within the tracked school system, these options overall do not contribute to closing gaps across parental SES-groups. Instead, it are the large, and increasing, gaps associated with the first school degree which seem to matter most for social inequality.

There are also two other reasons why upgrading likely does not contribute substantially to reducing disparities by parental background. First, many of the upgraders (about 40 % in all cohorts) attend vocational schools which only offer a higher secondary degree after 12th grade (*Fachhochschulreife, FHR*), as compared to the traditional *Abitur* after 13th grade. The former only provides access to tertiary education at universities of applied sciences, while the latter additionally provides access to traditional universities. Second, as will be shown in Section 5.3.3 below, many of the upgraders in fact do not continue with tertiary education at all, but instead take up vocational training.

5.3.3 Postsecondary Education

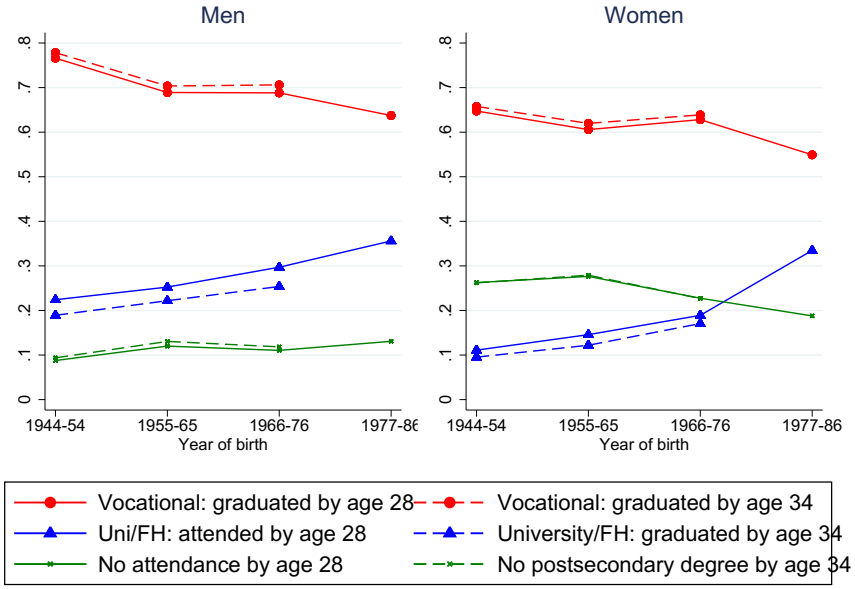
We now analyze trends in postsecondary education. Figure 5.3 shows that between the 1944-54 and 1977-86 cohorts, the share of those having attended tertiary education by age 28 increased from 22 % to 36 % for men, and from 11% to 34 % for women. Women still substantially lag behind men in the older cohorts, but their tertiary attendance rates then increase sharply for the youngest cohort (those born 1977-86). Vocational training is still the most common type of post-school training in all cohorts, but in line with the rise of tertiary education, its role has decreased recently.[12]

Figure 5.3 also considers whether a person, by age 28, has neither completed vocational training nor has attended university. We find that the share of these problematic trajectories has increased among young men (from 9 % to 13 %), but has decreased for young women (from 27 % to 19 %). This shows that while women have made progress over time, they are still more likely than men to remain without qualified post-school training even in the youngest cohorts. This stands in sharp contrast to women's better performance in terms of school degrees (see Section 5.3.1.). As shown in Figure 5.3, this is also driven by women's lower participation in vocational training.[13]

[12]Note that the categories tertiary and vocational education are not mutually exclusive as a person can attend one after the other.

[13]See also Beicht and Granato (2010) for a further analysis of gender gaps in vocational training. One explanation in the literature is gender-specific occupational choices, as men choose among a large range of occupations in crafts or manufacturing which offer more vocational training places, while occupations in the service sector offer fewer vocational training places. This explanation is also consistent with our finding that the gender gap is largest among lower secondary graduates (at around 20 ppts.). These youth typically do not have access to full-time vocational schools, which require at least a middle secondary degree and offer many training occupations popular among females (such as nursing or child care).

Figure 5.3: Postsecondary attainment



Note: The graph shows the share of each birth cohort having graduated from or attended one of the types of postsecondary education. Source: NEPS SC6, own calculation.

Again, it is instructive to distinguish between different "direct" and "indirect" pathways towards tertiary education, which is done in Table 5.3. "Direct" pathways ("Higher sec. → Tertiary") are those individuals that attend tertiary education after having obtained the higher secondary degree. "Indirect" pathways ("Higher sec. → Vocational → Tertiary") are those where an individual leaves higher secondary school to complete vocational training, and then attends tertiary education afterwards.[14] This indirect pathway is much more prevalent among men. This gender difference is largely driven by men who complete vocational training in a technical occupation, and then go on to study at a university of applied sciences, which also typically offer technical fields of study. Both direct and indirect pathways to tertiary education have increased across cohorts.

Table 5.3 shows how tertiary attendance varies with parental background. Panel A considers as outcome whether a person has attended tertiary education at any time by age 28, pooling both "direct" and "indirect" pathways. Among men, the increase in tertiary attendance has been much stronger for the fourth and fifth SES quintiles (+25.7 and +19.9 ppts., respectively) than among the bottom SES quintile (+5.9 ppts). A similar result holds for women, with especially the women from the fourth quintile seeing by far the greatest increase in tertiary attendance (+37.6 ppts.), as compared to an increase of 9.5 ppts. for women from the bottom SES quintile.

Panels B and C of Table 5.3 again consider the question how the "indirect" route towards ter-

[14] The "indirect" pathway also includes a small number of individuals who attend tertiary education after vocational training without having obtained a higher secondary degree at all. See also Rzepka (2018) for a further discussion.

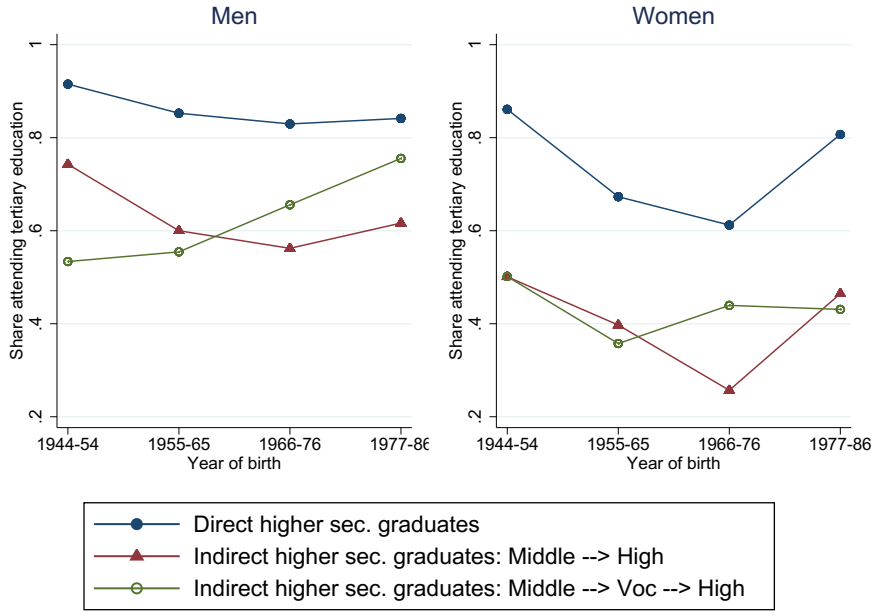
Table 5.3: Tertiary attendance by age 28, by birth cohort and quintile of parental SES

	Men					Women				
	1944-54	1955-65	1966-76	1977-86	Change 44-54 77-86	1944-54	1955-65	1966-76	1977-86	Change 44-54 77-86
A. Total tertiary attendance										
All	.224	.252	.297	.356	.132	.111	.146	.189	.335	.224
By SES quintile:										
Lowest	.13	.112	.155	.189	.059	.049	.094	.128	.144	.095
Second	.096	.13	.16	.159	.063	.02	.066	.027	.118	.098
Third	.189	.117	.115	.304	.115	.057	.057	.133	.209	.152
Fourth	.204	.243	.291	.461	.257	.067	.133	.137	.443	.376
Highest	.332	.465	.502	.531	.199	.235	.24	.386	.524	.289
Father self-empl. /civil-servant	.278	.315	.39	.44	.162	.165	.22	.274	.452	.287
Gap Q5 vs. Q1	0.202	0.354	0.347	0.342	0.140	0.186	0.146	0.258	0.380	0.194
	(0.066)	(0.042)	(0.052)	(0.068)	(0.084)	(0.047)	(0.034)	(0.045)	(0.066)	(0.070)
B. Direct path: Higher sec. → Tertiary										
All	.152	.197	.212	.25	.098	.094	.129	.155	.283	.189
By SES quintile:										
Lowest	.067	.091	.098	.113	.046	.036	.09	.093	.141	.105
Second	.036	.07	.085	.062	.026	.017	.054	.016	.086	.069
Third	.123	.082	.079	.17	.047	.046	.048	.112	.174	.128
Fourth	.105	.189	.185	.318	.213	.067	.112	.111	.37	.303
Highest	.203	.426	.372	.44	.237	.205	.207	.332	.439	.234
Father self-empl. /civil-servant	.218	.255	.295	.326	.108	.137	.197	.235	.395	.258
Gap Q5 vs. Q1	0.136	0.335	0.275	0.327	0.190	0.169	0.117	0.239	0.298	0.129
	(0.056)	(0.038)	(0.047)	(0.061)	(0.076)	(0.044)	(0.032)	(0.042)	(0.064)	(0.066)
C. Indirect path: Higher sec. → Voc. . → Tertiary										
All	.073	.055	.085	.106	.033	.017	.017	.034	.052	.035
By SES quintile:										
Lowest	.063	.02	.057	.076	.013	.013	.004	.035	.003	-.01
Second	.06	.06	.075	.097	.037	.004	.012	.01	.033	.029
Third	.067	.034	.036	.134	.067	.011	.01	.02	.035	.024
Fourth	.099	.054	.106	.144	.045	0	.021	.025	.074	.074
Highest	.129	.039	.13	.091	-.038	.03	.033	.054	.086	.056
Father self-empl. /civil-servant	.061	.061	.095	.114	.053	.029	.022	.039	.056	.027
Gap Q5 vs. Q1	0.066	0.019	0.072	0.015	-0.051	0.017	0.029	0.019	0.082	0.065
	(0.041)	(0.023)	(0.033)	(0.045)	(0.053)	(0.020)	(0.013)	(0.021)	(0.033)	(0.032)
N	1399	2086	1346	948		1243	2238	1485	886	

Note: The table shows the share of each birth cohort and parental SES quintile who have attended tertiary education on the direct pathway or the indirect pathway. Parental SES quintiles are defined based on the median wage in the father's occupation when the respondent was 15. Father's wages are merged based on administrative data provided by Hausmann et al. (2015), and quintiles are defined within each cohort. Source: NEPS-SC6, own calculation. Standard errors in parentheses.

tiary education (i.e., studying after graduating from vocational training) affects intergenerational mobility. We reach a similar conclusion as in the analyses above considering "second-chance" school degrees. Most of the gap in university education between high- and low-SES children is driven by the large gaps in the "direct" pathway. The gaps for the "indirect" pathway are much smaller in magnitude, but are still slightly positive, so they do not contribute to closing the gaps.

Figure 5.4: Tertiary attendance conditional on higher sec. graduation, by type of higher secondary degree



Note: The graph shows the share of higher secondary graduates in each birth cohort who have also attended tertiary education. Source: NEPS SC6, own calculation.

Finally, we show in Figure 5.4 tertiary attendance conditional on whether a person has obtained a higher secondary degree. Trends in these conditional rates are more difficult to interpret as the share of pupils obtaining a higher secondary degree has increased sharply over time (see Figure 5.2). Thus, it is possible that in recent cohorts the group of those who obtain the degree has become a more negative selection in terms of ability or motivation to study.[15] In line with this selection story is the finding that tertiary attendance rates generally decreased for higher secondary graduates of both genders from the 1944-54 to the 1966-76 cohorts.[16] However, this trend reverses from the 1966-76 to the 1977-86 cohorts and tertiary attendance of higher secondary graduates in-

[15] See Juhn et al. (2005) or Carneiro and Lee (2011) for a discussion of selection issues in analyzing returns to education over time, as well as Riphahn and Schieferdecker (2012) who also study tertiary attendance decisions conditional on higher secondary graduation.

[16] Further analyses (not shown here) indicate that most of those higher secondary graduates who do not continue with tertiary education instead opt for vocational training.

creases again, even though higher secondary graduation rates also increased strongly. Concerning gender differences, it is remarkable that female higher secondary graduates are much less likely to study than their male peers in the older cohorts, but that this gender gap almost has closed in the youngest cohorts.

In light of the analyses in Section 5.3.2., we also distinguish in Figure 5.4 between those who obtained the higher secondary degree on the "direct" path (as their first school degree) and those who obtained the degree via one the two types of "indirect" pathways, after upgrading from middle secondary school. Upgraders are on average less likely to attend tertiary education. This finding is relevant as it shows that these "indirect" pathways to the higher secondary degree, which are used more often by children from low-SES backgrounds, do not result in the same post-school outcomes as "direct" pathways.

5.4 Labour Market Outcomes

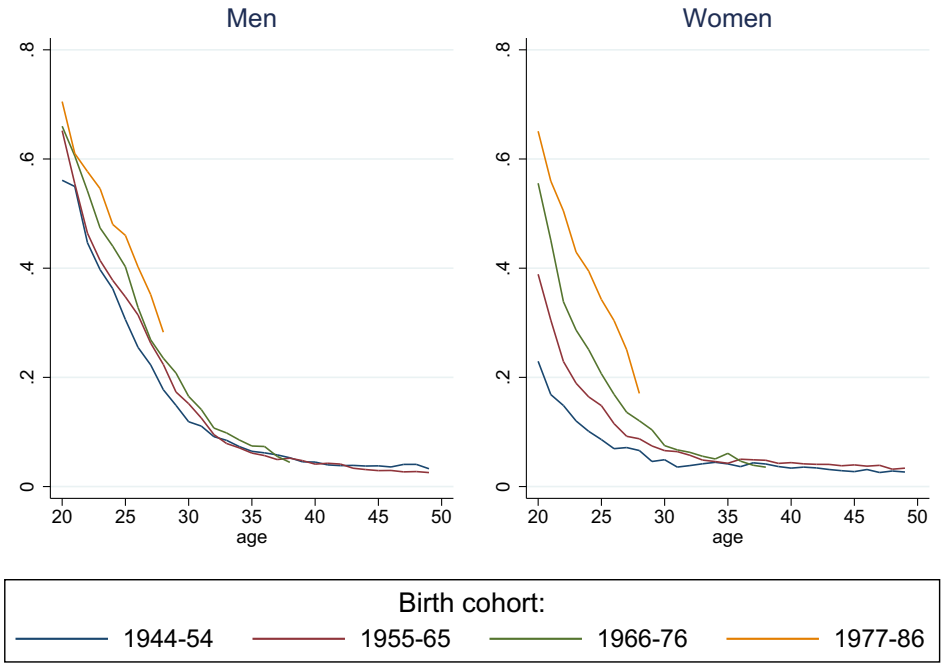
To obtain a glimpse of how life-cycle profiles in labour market outcomes have developed across cohorts, Figures 5.5a to 5.5d show the individuals' activities between ages 15 and 45. We distinguish between four types of activities: "education" (schooling, vocational education, tertiary education, and military service), "full-time employment" (all jobs with at least 35 hours per week), "part-time employment" (jobs between 5-34 hours per week), and "non-employment/marginal employment" (jobs with less than 5 hours/week, unemployment, or being out of the labour force).[17] In case of multiple activities per age, we assign priorities to the activities in the mentioned order, i.e. an individual holding a job parallel to his university studies would be classified as being in education.

Figure 5.5a demonstrates, in line with the previous findings, that both men and women of recent cohorts spend a longer time in education compared to older cohorts. In terms of employment patterns, though, there are very different trends by gender. For men, full-time employment at any given age declined across cohorts (Figure 5.5b). For example, the share of men working full-time at age 28 declined from 77 % in the 1944-54 cohort to 60 % in the 1977-86 cohort. This is not only driven by men spending a longer time in education, but also by a sharp increase in non-employment or marginal employment, as shown in Figure 5.5d. The share of men who are not or only marginally employed at age 28 increased from about 3 % in the 1944-54 cohort to 10 % in the 1977-86 cohort. It is still unclear whether this merely reflects a transitory difficulty of the young generation to find stable employment, or whether there will be permanent level differences also at older ages compared to previous cohorts. However, a concerning observation is that the 1966-76 cohort of men already shows slightly higher non-employment rates in their 30s than previous cohorts did at the same age.

[17] Bachmann et al. (2017), also using data of the NEPS SC6, provide an extensive analysis of different types of marginal employment, such as different types of part-time work, temporary agency work, etc.

Figure 5.5: Activities by age

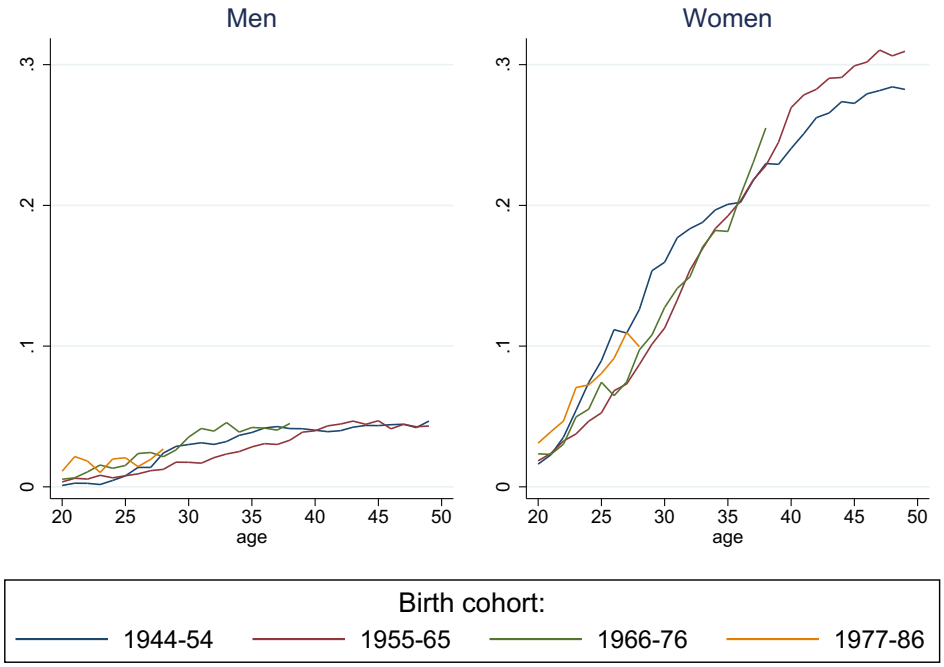
a) Share in education



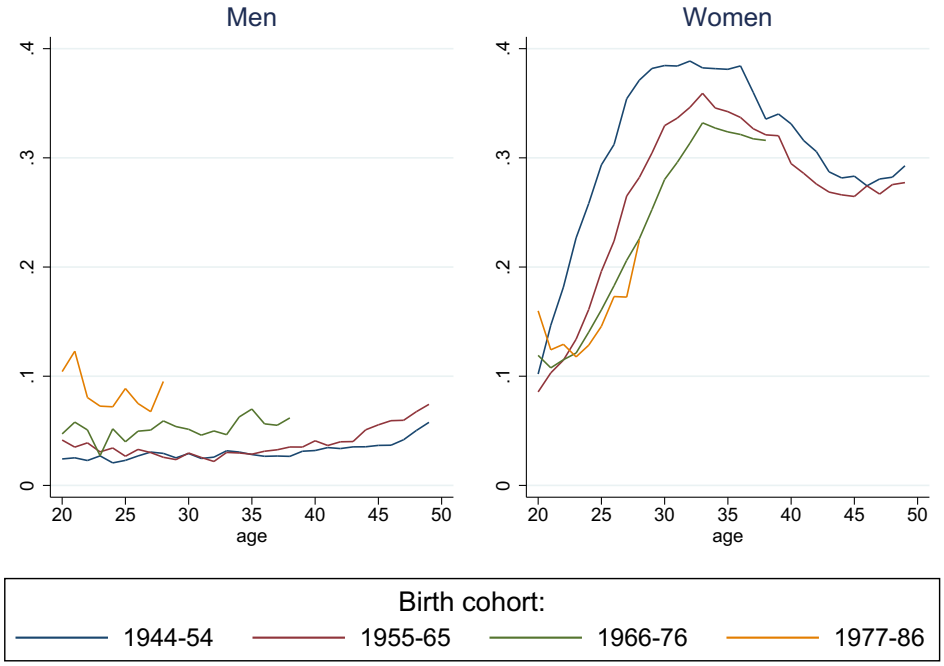
b) Share in full-time employment ($\geq$ 35 hours/week)

Note: The graph shows the share of individuals who perform a certain activity at a given age. In case of multiple activities per age, priority was assigned in the order Education > Fulltime > Parttime > Non-employment. Source: NEPS SC6, own calculation.

c) Share in part-time employment (5-34 hours/week)



d) Share in non-employment/marginal employment <5 hours/week



Note: The graph shows the share of individuals who perform a certain activity at a given age. In case of multiple activities per age, priority was assigned in the order Education > Fulltime > Parttime > Non-employment. Source: NEPS SC6, own calculation.

For women, non-employment rates declined substantially across cohorts (Figure 5.5d, right panel), albeit starting from much higher levels. This trend seems to have stopped between the 1966-76 and 1977-86 cohorts. Full-time employment rates during the early 20s decreased for women, reflecting their longer time in education, but they increased for women in their late 20s or 30s, likely reflecting increasing delay of childbirth and the greater incidence of returning to full-time employment after childbirth. However, despite the greater progress of women, their non-employment rates are still at much higher levels than those of men.

How does labour market attachment vary between individuals coming from different parental backgrounds? Table 5.4 considers as outcome non-employment at age 28. The rising incidence of non-employment among young men is much stronger for those from the bottom quintile of parental SES (+13.2 ppts.) then for those from the top quintile (+3 ppts.). For women, non-employment rates at age 28 declined between the 1944-54 and 1966-76 cohorts for all parental SES groups, but increased again between the 1966-76 and 1977-86 cohorts mainly for women from the bottom SES quintile. Overall, these results suggest that in the youngest cohorts it were especially men and women from low parental SES which face higher risks of nonemployment.

Table 5.4: Non-employment at age 28, by parental background

	Men					Women				
	1944-54	1955-65	1966-76	1977-86	Change 44-54 77-86	1944-54	1955-65	1966-76	1977-86	Change 44-54 77-86
All	.029	.026	.059	.095	.066	.371	.286	.226	.225	-.146
By SES quintile:										
Lowest	.029	.033	.073	.161	.132	.364	.298	.263	.399	.035
Second	.025	.036	.052	.171	.146	.45	.338	.316	.179	-.271
Third	.003	.018	.047	.089	.086	.368	.308	.289	.255	-.113
Fourth	.032	.044	.089	.043	.011	.398	.33	.197	.182	-.216
Highest	.037	.011	.056	.067	.03	.242	.185	.151	.107	-.135
Father self-employed /civil-servant	.038	.024	.061	.08	.042	.349	.25	.18	.202	-.147
Gap Q5 vs. Q1	0.008 (0.027)	-0.022 (0.016)	-0.017 (0.028)	-0.094 (0.047)	-0.102 (0.044)	-0.122 (0.074)	-0.112 (0.044)	-0.112 (0.049)	-0.293 (0.070)	-0.170 (0.086)
N	1399	2086	1346	948		1243	2238	1485	886	

Note: The table shows the share of each birth cohort and parental SES quintile who were non-employed (or employed with less than 5 hours/week) at age 28. Parental SES quintiles are defined based on the median wage in the father's occupation when the respondent was 15. Father's wages are merged based on administrative data provided by Hausmann et al. (2015), and quintiles are defined within each cohort. Source: NEPS-SC6, own calculation. Standard errors in parentheses.

5.5 Conclusion

This paper has studied the question of how the educational expansion of previous decades has affected children coming from different parental background and hence intergenerational mobility. We find that children from all parts of the parental SES distribution show rising rates of higher secondary graduation and tertiary attendance, in particular women. However, as these increases were most pronounced for children coming from high parental SES groups, educational disparities by parental background have increased. We have additionally provided an in-depth analysis of "second chance" options in Germany's education system, in particular the possibility to "upgrade" to a higher secondary school degree after 10th grade, or the option to study at university after completing vocational training, and found that these second chance options overall do not contribute to closing the gaps. Finally, we also have documented rising gaps in terms of labour market outcomes between children of different parental SES groups.

Our results are in line with studies for the US (Belley and Lochner 2007, Bailey and Dynarski 2011) or the UK (Lindley and Machin 2012) which also have suggested that educational expansion has increased, rather than mitigated, social inequality in the access to education. This shows that advancing the educational prospects of children from less fortunate parental backgrounds will remain a pressing policy issue in the future.

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Selbständigkeitserklärung

Ich erkläre, dass ich die vorliegende Arbeit selbständig und nur unter Verwendung der angegebenen Literatur und Hilfsmittel angefertigt habe.

Ich bezeuge durch meine Unterschrift, dass meine Angaben über die bei der Abfassung meiner Dissertation benutzten Hilfsmittel, über die mir zuteil gewordene Hilfe sowie über frühere Begutachtungen meiner Dissertation in jeder Hinsicht der Wahrheit entsprechen.

Berlin, den 7. Januar 2019 Markus Zimmermann